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ABSTRACT

This information summarizes the University of Dayton (Ohio) Women in Science Career Facilitation Project entitled Fast Track Late Entry. The University of Dayton Fast Track Program was designed to bring women with bachelor's degrees in mathematics, chemistry, or physics to a technical level in chemical or electrical engineering equivalent to bachelor degree recipients and to qualify them for master's degree work in chemical or electrical engineering. The program consisted of: (1) procedures to diagnose and evaluate backgrounds of participants; (2) examinations to determine placement in the mathematics sequence; (3) six credit hours of reentry mathematics taken by participants in the Chemical Track; (4) specific chemical and electrical core courses designed for, and made available to, Fast Track students; (5) courses designed to integrate the students into the regular undergraduate curriculum in chemical and electrical engineering; (6) a Professional Development Course; (7) a tutorial center for Fast Track students; and (8) evaluation procedures. Seventy-one women were accepted into the Fast Track Program and 63 graduated. Seventy percent of the participants relocated to attend the Fast Track Program. Sixty-one women received employment, many with Fortune 500 companies. (TW)

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ED287694

FINAL REPORT

Career Facilitation Grant
1976 - 1979
Women in Science Program

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UNIVERSITY OF DAYTON
DAYTON, OHIO 45469

SCHOOL OF ENGINEERING
OFFICE OF THE DEAN

March 30, 1981

National Science Foundation
Division of Grants and Contracts
Post-Award Projects Branch
1800 G Street, N.W.
Washington, D.C. 20550

Dear Sir:

Attached are two (2) copies of the Final Report for Grant SPI 76-20470 and its Renewal SPI 76-20470 A01.

Sincerely,

Carol M Shaw

Carol M. Shaw
Project Director

CMS/sg

Attach.

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

FINAL PROJECT REPORT
NSF FORM 98A

PLEASE READ INSTRUCTIONS ON REVERSE BEFORE COMPLETING

PART I–PROJECT IDENTIFICATION INFORMATION

1. Institution and Address	2. NSF Program	3. NSF Award Number
University of Dayton 300 College Park Dayton, Ohio 45469	Women In Science	SMI76-20470 and A01
	4. Award Period From Jun 1976 To Oct 1980	5. Cumulative Award Amount $290,364

6. Project Title

Fast Track Late Entry Program

PART II–SUMMARY OF COMPLETED PROJECT *(FOR PUBLIC USE)*

This information summarizes the University of Dayton Women in Science Career Facilitation Project entitled Fast Track Late Entry. The University of Dayton Fast Track Program was designed to bring women with Bachelor's Degrees in Math, Chemistry, or Physics to a technical level in Chemical or Electrical Engineering equivalent to Bachelor Degree recipients and to qualify them for Master's Degree work in Chemical or Electrical Engineering. The need for this reentry program was empnasized by two facts: (a) Top job and salary offers were going to engineers (50 percent of all job offers to 1977 college graduates went to engineers); and (2) Competition for employment in the field of science and mathematics where women comprise a fairly large percentage of graduates was particularly keen. The success of the program was facilitated by linking the area in which the participants received their earlier training for Bachelor's Degree to the proposed reentry curriculum.

The program consisted of procedures to diagnose and evaluate backgrounds of participants; examinations to determine placement in the mathematics sequence; six credit hours of reentry mathematics taken by participants in the Chemical Track; specific chemical and electrical core courses designed for, and made available to, Fast Track students (offered for credit); courses designed to integrate the students into the regular undergraduate curriculum in Chemical and Electrical Engineering; a Professional Development Course; a tutorial center for Fast Track students; and evaluation procedures.

A variety of educational modes were used in the instructional phase of the Fast Track Program. The Chemical Engineering Track used predominantly lecture techniques with shortened summer school-type semesters lasting seven weeks. The Electrical Engineering Track utilized self-paced courses specifically designed to transition adult reentry students with backgrounds in mathematics into electrical engineering. Seventy-one women were accepted into the Fast Track Program and 63 graduated. Participants were recruited nationwide by asking interested colleges and universities to supply their alumni mailing list. Seventy percent of the participants relocated to attend the Fast Track Program. On a questionnaire supplied to the participants, 60 percent indicated they were underutilized or underemployed in terms of their previous degree. Thirty percent of all the applicants already had Master's Degrees. Sixty-one women received employment, many with Fortune 500 companies, at salaries that ranged from $14,000 to $26,000. Follow-up evaluation data administered to the supervisors of reentry women and the 1977 comparable undergraduate classes found comparable performance evaluation results.

PART III–TECHNICAL INFORMATION *(FOR PROGRAM MANAGEMENT USES)*

1. ITEM *(Check appropriate blocks)*	NONE	ATTACHED	PREVIOUSLY FURNISHED	TO BE FURNISHED SEPARATELY TO PROGRAM	
				Check (✓)	Approx. Date
a. Abstracts of Theses	X				
b. Publication Citations		X			
c. Data on Scientific Collaborators	X				
d. Information on Inventions	X				
e. Technical Description of Project and Results					
f. Other *(specify)*					

2. Principal Investigator/Project Director Name *(Typed)*	3. Principal Investigator/Project Director Signature	4. Date
Carol M. Shaw	Carol M Shaw	Mar 31,1981

NSF Form 98A (5-78) Supersedes All Previous Editions

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FAST TRACK

THE UNIVERSITY OF DAYTON CAREER FACILITATION PROGRAM

Carol M. Shaw, Assistant Dean of Engineering
University of Dayton

SECTION 1
INTRODUCTION

Before we discuss the University of Dayton Career Facilitation Program --Fast Track, it is important to appreciate the significance of career facilication programs and their potential impact on the career patterns of women and their entry and reentry into the science and engineering labor force.

The University of Dayton experience confirms another study by Burks which reported that thirty-eight percent of respondents to a questionnaire survey of two thousand professional women indicated they had experienced career interruptions. Respondents to the questionnaire were members of five professional societies and, therefore, as a group can be considered to be highly dedicated to career development. The data show that over one-third of the group support our premise that reentry or late entry into career fields is now, and will continue to be, a viable but critical career path for women in science and engineering.

Consider the following systems model which represents three basic phases in women's career development: (1) the basic education phase, (2) the home and family phase, and (3) the career phase. There are several career paths available to women: Path A represents women who enter the career phase after the education phase and remain there; Path B represents women who enter the home and family phase after the education phase and remain there; and Path C represents women who enter the career phase and/or the

home and family phase and at some point in their lives transfer back and forth between these phases. The systems model for the educational and employment patterns of women is represented by Figure 1.

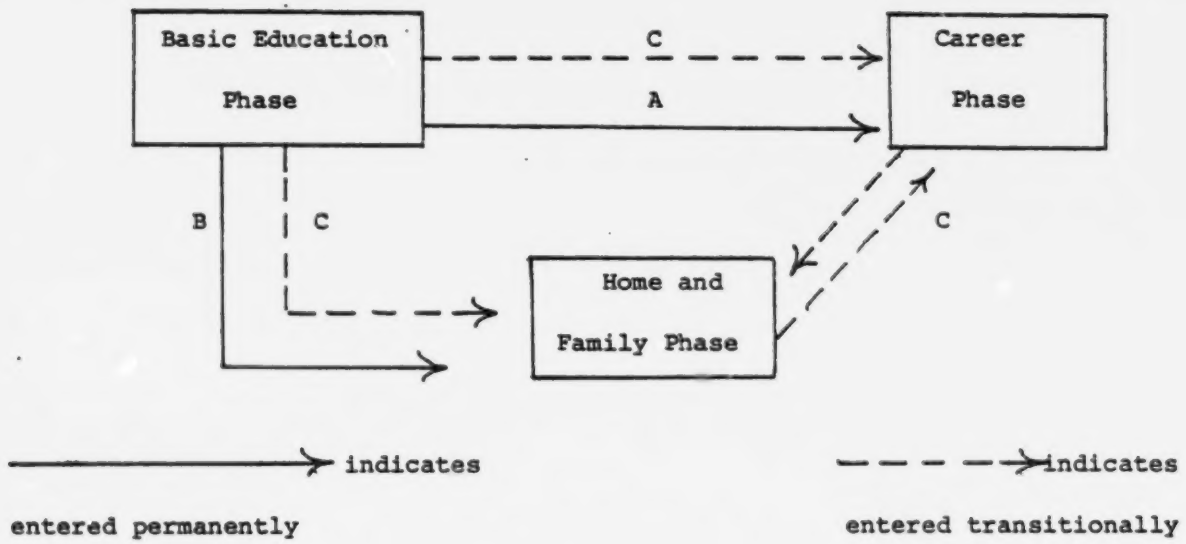


Figure 1.

The systems model indicates that because women are the child bearing sex they are faced with a unique dilemma when planning a career. The dilemma arises when women consider their options: should they exclusively choose either the career or family phase, should they choose to temporarily enter one or more of these phases or should they try to integrate the phases.

Gail Sheehy sheds light on how women have responded to this dilemma by indicating that many women have looked at the choice between a career and a family as an "either or" choice. Sheehy classifies women either as achievers who defered

nuturing or nuturers who defered achieving. Hennings provides further insight into the "either or" dilemma by citing that "among women who are remarkably and visably accomplished, a significant number did not become mothers until they were 35 or over".

Although there is significant data that women have faced the decision between the career and family phase as an "either or" choice an obvious question arises. Isn't it possible to integrate a family and career?, and if so, when does it work best? Although individual success stories of integrating family and career are certainly known, Sheehy points out that "it is rarely possible for a woman to integrate marriage, career, and motherhood in her twenties, quite possible at 30, and decidedly possible at 35, but before then, the personal integration necessary as a ballast simply hasn't had a chance to develop."

This data would seem to indicate that the systems model is not complete for women who want both a family and a career. Some women are going to raise families and enter the career phase as late entrants, others are going to integrate families and careers as they approach their 30's and others are going to transfer back and forth between the career phase and the home and family phase as they experience one or more career interruptions.

It is obvious that we need educational programs and strategies that will facilitate re-entry into the career phase from the home and family phase and that will provide for an easier integration of career and family at the time women can accomodate this integration. Most importantly, we need educational programs, financial aid, and other strategies that are recognized, fixed in place and accepted as a mechanism for relieving the "either or" choice faced by women who want a family and a career.

A NEW SYSTEMS MODEL

Based on this viewpoint, it is also apparent that we can revise the systems model. A model that represents the career and family phase is incomplete without including a phase that facilitates career re-entry for women who have suffered career interruptions due to entering the home and family phase--A Reentry Strategy. The systems model based on the hypothesis that a reentry strategy is necessary for women (and other facing career change, career transition or career obsolescence) is represented by Figure 2. Establishing a reentry strategy could also have the added advantage of strengthening the family because women would no longer hesitate to tackle nontraditional career areas such as science and engineering because they would no longer be afraid to interrupt a career in order to assume family obligations. At present, women may especially hesitate to interrupt specialized or technological careers, because they face the choice of becoming obsolescent in their field during the interruption, and not assuming a desirable family commitment.

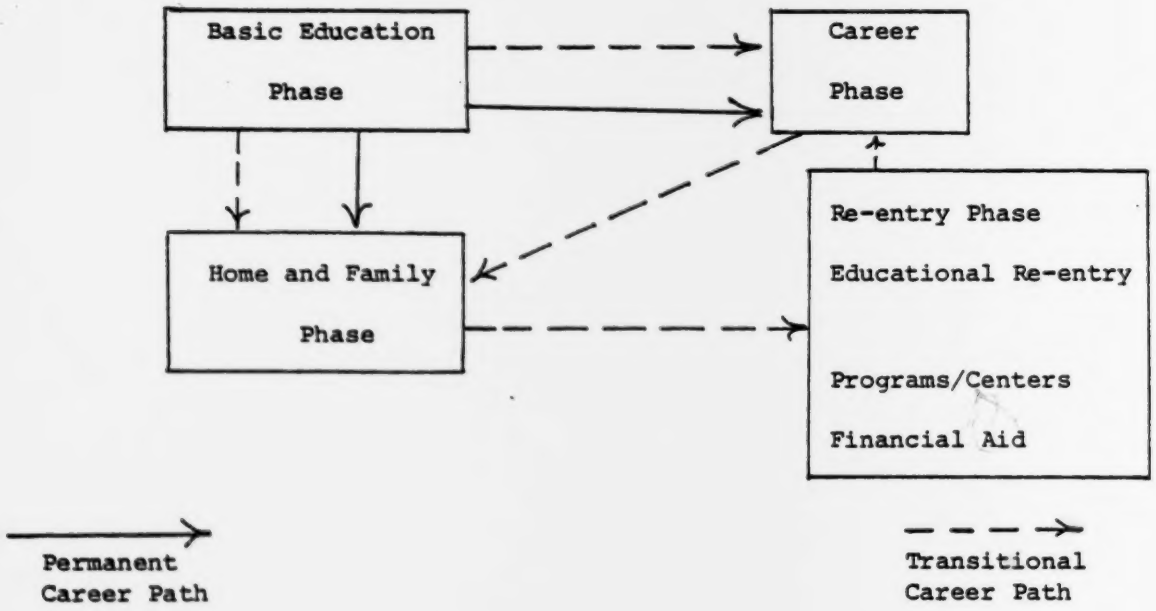


Figure 2.

The Career Facilitation programs initiated by the National Science Foundation have proven a unique model to aid in the transition between the career and home and family phase. The University of Dayton Reentry Program, Fast Track, has provided a variety of opportunities and experiences that will contribute to the knowledge about the educational needs of reentry women and the ways colleges and universities can respond to these needs.

SECTION 2

RATIONALE FOR A REENTRY PROGRAM - FAST TRACK

There were three independent factors that provided the background for Fast Track to be conceptualized at the University of Dayton. We had initiated two experimental late entry programs in engineering that were designed for local audiences, and we had experience in designing educational programs that would increase the number of women entering science and engineering. Concurrently, the National Science Foundation recognized the importance and need for a career facilitation strategy for women and initiated the Women in Science Program.

Our early reentry programs in engineering included a retraining program for chemists employed by the Monsanto Research Corporation and The Bachelor of Engineering Program, (BEN), a reentry program for local nondegreed people who work in engineering related positions. The (BEN) program provides the mechanism for mature persons who are working full-time to pursue a multidisciplinary engineering program. The average length of time needed to complete the BEN program is four to five years.

The experience gained from the Monsanto Retraining Program and the BEN program was used to develop a Fast Track Late Entry Program for Women in Engineering. Further, some of the courses initially developed for the prototype late entry programs were modified for a Fast Track reentry approach. However, we felt that in order for the Fast Track late entry concept to work, there would have to be a link between the proposed Fast Track engineering curriculum and the area in which the program participants received their earlier training or bachelor's degree. It was reasonable that chemists and physicists could be retrained to function as chemical engineers

and that physicists and mathematicians could be retrained to function as electrical engineers. The similarity and overlap of the technical content of these areas indicated the feasibility for the program to be fast tracked, that is, offered in a condensed period of time. The desirability of the program was emphasized by two facts: (a) top job salary offers were being received by chemical engineers, and (b) the competition for employment in the field of mathematics, where women comprise a comparatively large percentage of graduates, was much keener than in the field of electrical engineering.

Once the Fast Track program was conceptualized, the previous experience with women in engineering programs and late entry programs for adults provided a framework for designing the important program components of recruiting, curriculum development, professional development, and placement for the graduates. A discussion of these components is described in the following chapters. This report includes a discussion of each of these components and their modifications for two Fast Track offerings termed Fast Track I and II. Fast Track I was offered in 1977 and Fast Track II in 1979.

SECTION 3

RECRUITING THE STUDENTS

The Recruiting Strategy

We planned a national strategy that would attract students to our program from various parts of the country. It was our philosophy that a reentry program that relied solely on local participants would eventually deplete the market of potential applicants unless the local population base was very large (i.e. New York, Los Angeles).

We designed a direct mail brochure (See Appendix A) which completely describes the goals and objectives of the program. We requested from alumni offices of universities east of the Mississippi, labels for women who received Bachelor's, Master's, or Doctorates in appropriate disciplines, and mailed brochures to these women.

Modifications to the Direct Mail Approach

Eighteen thousand brochures were mailed to qualified candidates during each of the two Fast Track recruiting periods. The mailing depended on receipt of the mailing labels from alumni offices and delivery of bulk mail. These two factors presented some problems in reaching candidates during the short recruiting period, July to November of 1976. Many candidates did not receive their brochures until late November or early December and encountered difficulty in providing transcripts and arranging schedules and family plans. Therefore, a longer recruiting period was utilized for Fast Track II. A seven to eight month recruiting period is considered ideal.

For both programs, we augmented the direct mail recruiting strategy with notices in appropriate journals such as Chemistry, IEEE Spectrum, Engineering Education Newsletter, and the Association for Women in Science,

and The American Mathematical Monthly. In addition, other professional organizations such as the American Women in Science, and the American Chemical Society, were contacted so that notices of the program could be put in local newsletters. The University of Dayton Information Services Center assisted in getting several newspaper and television interviews in the local press, (consult Appendix A). After each program, we asked participants how they actually learned about the program. Table I summarizes the results of that survey for Fast Track I.

TABLE I

FAST TRACK I	Direct Mail Brochure	6
	Letter (Brochure Incl.)	13
	Newspaper Advertisement	5
	Personal Contact	3
	Media	3

It is obvious that every form of recruitment worked. However, we feel the majority of our initial contacts occurred through the names of women science graduates provided by alumni offices in colleges and universities throughout the country. We will elaborate on how we obtained these mailing labels because several other universities tried this strategy but were not able to achieve our level of success.

To determine how participants of Fast Track II learned about the program we also asked the participants how they heard about the program. Their responses are listed in decreasing order of occurence.

Brochure mailed to me	13
Other	9
Friend	8
Newspaper article	6
University of Dayton Alumni	3
Radio	2
Contacted by Project Director	1

Recruiting Through University Alumni Offices

The direct mail strate[illegible] depended upon the cooperation of alumni offices of universities whi[illegible] had awarded the appropriate degrees to women. We requested labels by sending a letter to alumni offices and a copy of the request to the President of these universities. For Fast Track I, an initial mailing was made to approximately 310 universities in the Midwest (consult Appendix A for a copy of the letter to alumni offices.) However, for Fast Track II, we mailed to all colleges and universities in the United States who graduated appropriately qualified women.

Each university was asked to either supply labels for their qualified graduates or to mail the brochures from their offices. For Fast Track I, 55 universities actually sent labels or a list of names and 24 universities chose to exericse an option of mailing the brochures from their office. For Fast Track II, 103 universities sent labels and 31 universities mailed our brochure to their alumni. Universities choosing the second option stated that the Privacy Act prevented them from releasing names of their graduates. A much smaller number of universities, eight for Fast track I and five for Fast Track II, published a summary of the project in their alumni news. Thirty-two universities in Fast Track I and 17 universities in Fast Track II were unable or unwilling to release the names of their graduates. There was

an almost equal division between universities who stated they were unable to comply and those that stated they were unwilling to comply.

The strategy of direct mail via alumni labels was successful. However, there are some difficulties encountered with this strategy. The primary drawbacks are: (1) gaining the attention of busy alumni directors, and (2) the lengthy turn around time encountered in receiving labels from alumni offices.

The normal lag time for receiving alumni labels from the date of the request was two to four months, with most of the labels arriving at three months.

A recruiting strategy that we tried for Fast Track I that did not prove to be important as an overall recruiting strategy for Fast Track was to elicit industry's help in locating applicants.

For Fast Track I, we mailed several brochures and an introductory letter to industries in the Midwest (see Appendix A). We requested the Chamber of Commerces of approximately 200 medium to large communities to supply lists of industries which employed scientists or engineers. One-hundred and forty Chambers of Commerce responded to this request, and many Chambers requested a small fee ($2.00-$5.00) for supplying such an industry list. As a result of securing the industry lists, we sent 5 to 20 brochures to 1,561 industries with a letter describing the program.

This strategy did not work as a recruiting strategy. Personnel directors did not distribute the brochure to employees who could benefit from the program. Applicants who were already working in engineering-related jobs were not encouraged by their employers to enroll in the program, even though the employers stated that the program was ideal for the applicant.

The reason given by a local employer was that industry did not wish to lose the women who were already employed. Several industries stated that they were afraid they would not be able to regain these same women as employees once the program was over. This attitude on the part of industry occurred in Fast Track I and II.

Even though the industry recruiting strategy did not seem to have a direct beneficial effect on recruiting, it had a tremendous beneficial effect in publicizing the program. Many industries became very interested in the program; and it was very easy to enlist industry support for the goals of the program and to involve them in the project. This involvement began in the initial Motivational Week of the first Fast Track program.

In addition, several applicants who thoroughly researched the program before deciding to enroll in the program questioned industries about their potential employability upon completion of the program. The fact that industry had been made aware of the program and had time to reflect on its goals and objectives was a positive factor in their overall attitude when questioned by program applicants.

Technical Societies

The third major recruiting strategy was to contact technical societies such as the American Chemical Society, The American Physical Society, and the American Mathematical Society in order to obtain address labels of their women members. The initial objective was to obtain the labels in order to use the direct mail strategy. However, these societies were either not equipped or not able to provide mailing labels for this purpose.

The American Chemical Society did provide lists of the secretaries of local ACS sections for the midwest area. Each of these secretaries was

contacted and asked to include a short description of the project in their local newsletter or to direct mail to women in their sections. Most sections chose to publish the description of the project in their local newsletters. This strategy was effective in reaching potential students for the Chemical track.

The only difficulty with this strategy proved to be the lag time in getting the names of the section secretaries and in getting information to them in time for monthly newsletters. No attempt was made to secure a list of the secretaries of the local chapters of the mathematical or physical societies. If time had permitted it would have been advantageous to do so.

Telephone Interviewing and Personal Recruiting

In order to completely discuss program recruiting strategies, it is necessary to discuss a phase of recruiting that was unexpected for Fast Track I, turned out to be extremely important, lasted from mid-December until the program began on January 18, 1977, and was completely nonexistent for Fast Track II. This phase of recruiting involved intensive telephone interviewing with follow-up personal interviews, if possible. It is important to discuss and review this phase of recruiting for Fast Track I because it is an indication of the extra effort needed to persuade participants to enroll in a program offered for the first time.

In mid-December, 21 applicants had accepted the Fast Track I Scholarship offer and 33 had refused the offer or had remained undecided. We then initiated telephone interviewing to elicit responses from undecided applicants and to determine reasons for negative responses to the program.

Six applicants had clearly indicated medical or family circumstances as reasons for negative responses; these applicants were not contacted during

this period, and they are not included in Table 1. However, if no explanation accompanied a negative response or if financial reasons were given as the reason for a negative response, the applicant was contacted.

Reasons for negative responses or no response at all (labeled undecided responses) fell into three categories:

(a) Responses related to psychological factors.

(b) Responses related to economic factors.

(c) Responses related to current employment.

Psychological Factors

Responses related to psychological factors seemed to be related to the applicant's "fear of risk taking" and/or believed inability to complete the academic portion of the program. Twenty-seven of the basic group identified in mid-December fell into the negative or undecided response subgroups. Categorizing for this subgroup was done by the project director and Nancy Cook Cherry, currently Director of Individual and Adult Oriented Programs for the School of Engineering. Mrs. Cherry was a psychologist consultant during this recruiting phase of Fast Track I.

The following case study describes an applicant who initially refused the scholarship offer in writing. This applicant had a Bachelor's degree in mathematics with all A's and one B on her transcript. She was also single with no financial problems and underemployed in her current position as a clerk in a factory. The initial telephone interview was not productive in eliciting a definite reason for the negative response, but the applicant did agree to come in for a personal interview.

The personal interview was a crucial factor in the ultimate positive response for this applicant and others in the negative or undecided category.

During this personal interview, the applicant clearly stated that "I knew when I was writing the rejection letter that I was doing the wrong thing. In fact, I was hoping that you would call and tell me that I should accept the offer." Further conversation revealed that in spite of her almost perfect grade point average, she had great fears about her ability to complete the program.

For Fast Track II we had many more applicants than openings. The basic difference was related to the fact that we were marketing a tested and proven program with real graduates that made it. Economic factors were also factors that related very differently to Fast Track I and II.

Economic Factors

At the onset of the telephone recruiting phase for Fast Track I, economic reasons were the primary reasons for most scholarship refusals or indecision.

Since economic factors were frequently mentioned early in the telephone recruitment phase, we initiated a major change in program design. We devised a strategy to offer small ($185 to $385) additional one-time stipends and/or part-time employment to these applicants.

A total of ten additional stipend offers and/or part-time employment opportunities were announced. A $285 grand would cover the cost of University housing for one semester (January-April). The amount of these stipend offers seemed to be sufficient to cause an applicant to seriously reconsider a rejection or indecision.

Two students out of six actually accepted stipend offers - one for $185 and one for $385. The stipends were offered directly from the School of Engineering and not from funds allotted by the National Science Foundation.

For Fast Track II the NSF included participant stipends as a budget item for the program and these were advertised in the brochure. This made the program much more marketable and we devised a strategy for applicants to apply for the stipends using a standard financial aid form.

Part-time employment was also viewed as a vital strategy to the success of both projects and will be seriously considered as a strategy in future career facilitation projects. Approximately one-third of the total group of Fast Track I and II have been employed in part-time positions during the program. During Fast Track I, it was a surprise that we needed to generate part-time employment. However, our efforts paid off; in Fast Track II we used the availability of part-time employment as a recruiting tool.

TABLE 2

FAST TRACK I

APPLICANT STATUS AND RESULTS OF THE DECEMBER TELEPHONE RECRUITING PERIOD

	Early Accepted	Undecided or Indefinite Negative	Conversion to Acceptance	Percent Conversions	Stipends and/or Part-Time Employment Offers	Offers Accepted	Percent Offers Accepted	Actually Enrolled 1-7-77
CHEMICAL	9*	11	5	46	7	4	57	13
ELECTRICAL	12	16	6	38	3	2	66	18

* 1 withdrew in January

SECTION 4

PUBLICITY

Publicity is itself a mechanism to recruit students. We augmented the direct mail strategy by sending articles announcing the program to technical journals, the public press, technical society newsletters, and television. All of these measures were important, but it would be difficult to assess their individual value. It should be clearly stated, however, that no advertisements were placed in any papers.

Refer to Appendix B for copies of publicity about the Fast Track Program. Examples of articles appearing in the local press, alumni news, industry newsletters, technical society newsletters, and technical journals include:

Engineering Educator News, November 1976

CES Newsletter of American Society for Engineering Education, November 1976

"NSF Backs Women in Engineering," University of Dayton Alumnus, October 1976

"This Year, For Women," News Case, October 1976

"Fast Track Late Entry Program for Women in Engineering," CIN TACS, ACS Newsletter, November 1976

"Wanted Students", Case Alumnus, October 1976

Engineering Education News, Vol. No. 4, October 1976

"UD to Return Women in Engineering Field," Catholic Telegraph,

"UD Recruiting Women for Engineering Degree," Dayton Daily News, August or September 1976

"UD Gets Grant for Women," Dayton Journal Herald, September 16, 1976

"UD Receives Grant for Women in Engineering," The Trotwood Sentinel, Trotwood, Ohio, September 15, 1976

"Women Engineers?," The Undermound, Monsanto Mound Laboratories, Vol. 2, No. 3, September 24, 1976

"Women Worry About Success in Engineering," Campus Report, University of Dayton, January 17, 1977

"NSF Backs Women," Campus Report, University of Dayton, August 30, 1977

DESC Electron, Vol. XIII, No. 16 - Defense Electronics Supply Center, February 18, 1977

Women Being Recruited Into Engineering Program, Campus Report, University of Dayton, 1978

27 Women to Make Journey to Fortune 500 List in One Year, University of Dayton Newsletter, October 3, 1978

Tuition-Free Degree, Science News, October 12, 1978

Free Tuition for Women, Engineering Education News, Vol. 5, No. 5, November 1978

Tuition-Free Degree, Science News, Vol. 114, No. 12, September 1978

UD Helps Students Engineer 4-Years of Work Into One, Dayton Daily News, April 16, 1979

Update For Fast Track, Mechanical Engineering, September 1979

Wanted: Women Engineers, Columbus Dispatch, March 31, 1980

Television coverage was also beneficial in the recruiting phase of the program. The project director was interviewed on WHIO-TV, on September 14, 1976 and the goals and objectives of the program were described to the television audience.

The publicity listed herein is only meant to be a sample of the type of publicity actually received. It was not possible to keep track of all such publicity received for the program.

The statement concerning advertising does not mean that it would not be valuable, but that it was not considered necessary due to the number of applicants that had responded to direct mail and other publicity measures.

However, if the budget had permitted, it probably would have been advisable to advertise in papers such as the New York Times and the Chicago Tribune. Advertising, however, should always be considered a secondary recruiting strategy.

SECTION 5

SELECTING THE PARTICIPANTS

The selection and review process for acceptance into Fast Track included evaluation by a selection committee which consisted of a mathematics professor, the department chairman in chemical or electrical engineering, and the project director. The applications were evaluated independently by members of the committee. Each candidate was rated on responses to standard questions on the application blank which allowed the committee to rate: (1) her previous academic record (which was given a weighting factor of two in the overall evaluation); (2) her ability to financially complete the program, the amount of time she would be able to spend in the workforce; (3) her dedication to work experiences; (4) her estimated dedication to completing the program. This information was gathered from the following application blank .

UNIVERSITY OF DAYTON

and the

National Science Foundation

Fast-Track II Late Entry Program

APPLICATION FORM

Name _____ Social Security _____/____/_____

Place of Birth _____

Permanent Address _____ Phone ( ) _____

City _____ State _____ Zip _____

American Citizen _____ Yes _____ No (If No, what is your visa status ____)

Please specify track interested in: _____ Chemical _____ Electrical

EDUCATIONAL RECORD

College or University Name, City & State	Degree Earned	Date of Graduation	Major Program of Study	Minor Programs of Study

List college level mathematics and science courses completed. List grades.

____ Introductory Calculus ____Advanced Calculus ____Differential Equations

____ Other ____Physics ____ Chemistry (Organic)

OCCUPATIONAL AND VOLUNTEER HISTORY:

Please account for all time since graduation. Use continuation sheet if necessary.

Dates	Occupation or volunteer activity, including job title, duties, employer or volunteer agency

APPLICATION QUESTIONNAIRE

1. What is the length of time and the periods during which you were not in a science or science-related career?

2. What are the reasons for not being in a science or science-related career?

3. What is your current career goal? How will engineering skills enhance your career goals?

4. Why did you apply and what do you expect to get out of participation in this project?

5. Honors, Leadership Positions, Community Activities, etc. (Use continuation sheet if necessary): _____

_____

_____

_____

6. Special Skills (e.g., Languages, etc.): _____

_____

_____

7. What kinds of support/problems might you encounter with your family and friends if you were a participant in the program?

_____

_____

_____

8. Tuition will be paid for program participants. Please indicate if further financial support will be necessary if your application is accepted.

_____ Yes _____ No

9. Please summarize your career goals, educational, work and volunteer experience that indicates you will be a good candidate for the program.

_____

_____

_____

_____

_____

ADDITIONAL VOLUNTARY PERSONAL DATA

1. Date of Birth _____

2. Race or ethnic background _____

3. Marital record _____

4. Number of children _____

5. Number of children at home _____

6. Arrangements (including costs) for child care, if any _____

_____

7. Occupation of husband, if married _____

8. Sources of financial support during participation _____

_____

COMPLETED APPLICATION

Your completed application consists of this form and your official college transcripts of all previous academic credits from the academic institutions in which they were earned. Mail this form and have official transcripts sent to:

Assistant Dean Carol M. Shaw
Project Director
Fast-Track Late Entry Program
University of Dayton
300 College Park
Dayton, Ohio 45469

NOTE: This form can be reproduced if additional copies are needed.

SECTION 6

PROFILE OF FAST TRACK PARTICIPANTS

Profile of Participants

In both Fast Track I and Fast Track II the profile of the participants was different for women entering the chemical and electrical tracks. In general, women entering the chemical track tended to be older, married, local, and with more science related work experience. The electrical track participants, on the otherhand, tended to be single, nonlocal, and the more underemployed of the two groups. Although not all were career teachers, a large percentage of participants in both programs (43%) had teaching experience.

The following data describes marital, educational, and employment characteristics of Fast Track I and II participants in relation to their specific track and whether or not they completed the program.

The Fast Track participants represented a variety of backgrounds. Approximately 60 percent of the participants from each program relocated to attend the program. Seven of the 71 participants in Fast Track I and II also had husbands or families who relocated with them and six relocated away from their husbands during the program. A large percentage of the participants had advanced degrees, 35 percent of the chemicals and 27.5 percent of the electricals. However, despite the fact that almost one-third of each group had masters degrees, a significant number of participants of both programs were underemployed.

Dr. Herman Torge, our Program Evaluator, interviewed participants from both Fast Track programs. In terms of the Fast Track participants work experience he reported "a few

had been in degree related work; several had been unemployed. Others had been in work related to their training. Most, however, had been underemployed or in work unrelated to their training. As a group they were not happy in their work or felt boxed-in with little possibility of upward movement. In almost every case each person had been looking for something else or had made serious inquiries for additional work at some college or university."

We asked participants in Fast Track II specific questions related to work experience and job satisfaction. A complete analysis of the responses to those questions are contained at the end of this section. Some of the participants' responses to those questions are summarized in Tables 3 and 4. Seventy-seven percent of the chemicals and 90.5 percent of the electricals were employed full-time at the start of the second Fast Track program. A trend that we noticed in Fast Track I continued in Fast Track II; the underemployed group was dissatisfied with their opportunities for promotion and advancement.

Ninety-two percent of the chemicals and 63 percent of the electricals reported they were dissatisfied with their opportunities for advancement with their current employer. A large percentage of each group also indicated they were dissatisfied with their opportunities for promotion and advancement in their line of work (85 percent of the chemicals and 73.7 percent of the electricals).

An indication that the job dissatisfaction of the group was not related to the people they were working with or other working conditions is illustrated by the fact that 84 percent of the electricals and 78.6 percent of the chemicals were either satisfied or very satisfied with their opportunity to relate to other people on the job. Sixty-six percent of the chemicals and 63 percent of the electricals also reported that they were either satisfied

TABLE 3

CHARACTERISTICS OF REENTRY WOMEN

	CHEMICAL		ELECTRICAL	
	Entering	Completing	Entering	Completing
		NUMBER OF WOMEN IN PROGRAM		
Fast Track I	13	9	18	18
Fast Track II	18	16	22*	20
	31	25	40	38
		SINGLE WOMEN		
Fast Track I	3	3	13	13
Fast Track II	7	7**	13	13
	10	10	26	26
		MARRIED WOMEN		
Fast Track I	8	4	5	5
Fast Track II	9	8	9	7
	17	12	14	12
		SEPARATED WOMEN		
Fast Track I	0	0	0	0
Fast Track II	1	0	0	0
	1	0	0	0
		DIVORCED WOMEN		
Fast Track I	2	2	0	0
Fast Track II	1	1	0	0
	3	3	0	0
		WOMEN WITH MASTER'S DEGREES		
Fast Track I	6	5	3	3
Fast Track II	5	5	7	7
	11	10	10	10
		WOMEN WITH TEACHING EXPERIENCE		
Fast Track I	6	4	5	5
Fast Track II	8	7	10	9
	14	11	15	14

*One woman dropped out during the motivational and diagnostic week and is not included in the data on mean ages, etc.

**Two were married during the program but are designated as single in these data.

AGES

	CHEMICAL		ELECTRICAL	
	Entering	Completing	Entering	Completing
		MEAN AGES		
Fast Track I	31.2	30.9	26.2	27.2
Fast Track II	31.9	32.4	27.8	28.7
		MEDIAN AGE		
Fast Track I	27	26	26.8	26.8
Fast Track II	30.5	31.5	27	28.3
		RANGE OF AGES		
Fast Track I	25-48	26-49	24-31	25-32
Fast Track II	23-44	24-44	23-38	24-39

TABLE 4

PARTICIPANTS RESPONSES TO QUESTIONNAIRE ON JOB SATISFACTION

ELECTRICAL RESPONSES

How satisfied were you with the following aspects of your job?*

	Very Satisfied	Satisfied	Neither Satisfied Nor Dissatisfied	Dissatisfied
Pay and Fringe Benefits	14.3	14.3	25.7	35.7
Opportunity for Developing Work Skills	0	35.7	21.4	42.9
Working Conditions	14.3	57.1	7.1	21.4
Pride and Respect I Receive from my Family and Friends by Having This Job	21.4	42.9	21.1	21.1
Opportunity to Use Training and Academic Subject Taken in College	5.3	26.2	5.3	63.2
Opportunity to Relate to Other People	31.6	52.6	15.8	0
Challenge	11.1	11.1	27.8	50.00
Opportunity for Promotion and Advancement With the Employer	21.1	10.5	5.3	63.2
Opportunity for Promotion and Advancement in This Line of Work	15.8	5.3	5.3	73.7

TABLE 4 (Cont'd)

PARTICIPANTS RESPONSES TO QUESTIONNAIRE ON JOB SATISFACTION

CHEMICAL RESPONSES

How satisfied were you with the following aspects of your job?*

	Very Satisfied	Satisfied	Neither Satisfied Nor Dissatisfied	Dissatisfied
Pay and Fringe Benefits	14.3	14.3	35.7	35.7
Opportunity for Developing Working Skills	35.7	21.4	42.9	0
Working Conditions	14.3	57.1	7.1	21.4
Pride and Respect I Receive From my Family and Friends by Having This Job	21.4	42.9	21.4	14.3
Opportunity to Use Training and Academic Subjects Taken in College	7.1	21.4	21.4	50.00
Opportunity to Relate to Other People	35.7	42.9	7.1	14.3
Challenge	15.4	15.4	15.4	53.8
Opportunity for Promotion and Advancement With the Employer	0	0	7.1	92.9
Opportunity for Promotion and Advancement in This Line of Work	7.1	0	7.1	85.7

TABLE 4 (Cont'd)

PARTICIPANTS RESPONSES TO QUESTIONNAIRE ON JOB SATISFACTION

CHEMICAL RESPONSES

How satisfied were you with the following aspects of your job?*

	Very Satisfied fied	Satis-fied	Neither Satisfied Nor Dissat-isfied	Dissat-isfied
Job Security	28.6	35.7	21.4	14.3
Supervisors	14.3	35.7	21.4	28.6
Job as a Whole	28.6	0	28.6	42.9

*The responses are adjusted for those not working

or very satisfied with their job security. However, despite the factors of job security and ability to get along with people on the job, usually very important in total job satisfaction, only 26.4 percent of the electricals and 28.6 percent of the chemicals were satisfied or very satisfied with their job as a whole.

The underemployment of Fast Track participants was also exemplified by their dissatisfaction with the opportunity to use their training in academic subjects taken in college in their current field of employment. Sixty-three percent of the electricals and 50 percent of the chemicals indicated they were dissatisfied with this aspect of their job.

Career Facilitation or reentry programs such as Fast Track are providing a valuable mechanism for underemployed women and women suffering career interruptions to reenter the scientific and engineering labor market.

Fast-Track Report II - Second Survey

In the second Fast Track Program we organized our approach to data gathering to focus on a single questionnaire. Participants were asked questions such as: how old are you; in what year did you receive your Bachelor's degree; and, did you experience a career interruption? The results were explored in terms of the total group and for each of the two programs: electrical and chemical engineering.

AGE

The mean age of the 36 women who completed the Fast Track II program was 30.36 years. The 16 women completing the chemical program were slightly older - a mean of 32.44, while the 20 who completed the electrical

engineering program averaged 28.7 years. A trend we noticed in Fast Track I continued, the chemical group was a slightly older group.

Year Received Bachelor's Degree

The years the women received their bachelor's degrees ranged from 1956 to 1977. The modal year was 1977 (6) and the median year was 1973. Among the women who completed the chemical program, the distribution was bimodal - 1975 and 1977 (3 cases each). The median year was 1972. For the women in the Electrical Fast Track program 1974 (4 cases) was the modal year and 1973 the median year.

Career Goals at Time of Bachelor's Degree

One-half of the 36 women reported that their career goals at the time they received their bachelor's degrees had been either "very vague" (7) or "vague" (11). Only five indicated that their career goals had been "very clear". When we examined the career goal data obtained from the chemical respondents, we again found one-half who stated their goald had been "very vague" (3) or "vague" (5). Among the 20 women completing the Electrical Fast Track, one-half placed themselves at the "very vague" and "vague" points on the five point continuum.

Career Interruptions Since Earning Bachelor's Degree

One question on the survey asked if the respondent's had experienced any career interruptions of six months or more duration. One-half answered "yes"; the other half "no". An examination of the responses from the women, both the chemical program and the electrical program, revealed an equal number replying "yes" they had and "no" they had not.

Number of Career Interruptions

The mean number of career interruptions was 1.78. Ten of the 18 who had experienced an interruption had experienced only one. Five of the eight women in the Chemical Fast Track who had a career interruption had only one. One of these eight had a total of six interruptions. One-half of the electrical students who reported a career interruption had expeienced one.

Occupation At Time of Entering Fast Track Program

Of the 35 students who reported their employment status at the time they were accepted into the program, seven (20 percent) indicated they were not employed. The largest number of women in any single field were five who were teachers. Four of those in the chemical program were not working previous to entering the Fast Track II program. An equal number in both tracks (three) had been teachers and science lab technicians. Only three of the 20 women in the electrical program were not employed. The largest single category of employed women consisted of five teachers.

Underemployed

When we asked of those who had been employed if they thought of themselves as being underemployed, 23 or nearly 80 percent, responded "yes". All except one of the 12 chemical students who had been employed considered themselves as having been underemployed. The percentage of women in the electrical program who were employed prior to entering Fast Track and felt they were underemployed was 70.6 percent or nearly ten percent less than that of their chemical engineer counterparts.

Difficulty of College Reentry

When asked how easy or difficult has it been for you to reenter the college environment, 25 of the 36 women completing the program, or nearly

70 percent felt it was "easy" (17 respondents) or "very easy" (8 respondents). Only three felt the reentry was "very difficult". Two of these three were in the chemical program. Fifty percent of the chemical students thought returning to the college environment was "easy" and another nearly nine percent considered this experience "very easy". Twenty-five percent of those in the electrical program regarded the return as "very easy". An additional 45 percent looked upon this experience as "easy."

College or Job Success Comparison

When asked, overall, do you feel that you have been more successful in college or working on a job, 21 of the 35 who had ever had employment reported that they had been equally successful in college and working on the job. Eight felt they had been more successful performing on the job, and six said in college. None of the chemical students considered themselves as having been more successful in college. Six, however, thought they had been more successful on the job. Interestingly enough, none of those studying to be chemical engineers thought they had achieved more success in college; six of the electrical expressed this opinion.

Source of Information About the Fast Track Program

The sources by which the participants learned about the existence of the program are rank-ordered below. The sum total of the number of times all the sources were cited exceeded the 36 respondents in the program because each student was given the opportunity to mention as many sources as appropriate.

Brochure	17
Other	9
Friend	8
Newspaper Ad	6
Alumnus	3
Radio	2
Contacted by Program Director	1

When we examined the responses of the chemical students the following results were obtained.

Brochure	6
Other	5
Friend	4
Newspaper Ad	4
Alumnus	2
Radio	2
Contacted by Program Director	1

The ranking of the sources by which the electrical students became aware of the program are as follows:

Brochure	11
Other	4
Friend	4
Newspaper Ad	2
Alumnus	1
Radio	0
Contacted by Program Director	0

Marital Status

Nineteen (52.8 percent) of the women reported being single, 16 married, one divorced, and none separated. Among those studying chemical engineering, half were married, six were single, and one was divorced. Sixty-five percent (13) of the electrical students were single and the remainder married.

A follow-up question directed to the 16 married students asked the extent of their husbands' approval or disapproval of their participation in the program. Two of 16 (12.5 percent) responded that their spouses registered approval and the remaining 14 said their husbands expressed strong approval. Of the nine married chemical engineering students, one reported that her husband approved of her participating, and eight stated that their husbands strongly approved. Among the chemical engineering students who were married, one instance, (14.3 percent) of approval and six instances of strong approval (85.7 percent) existed.

Temporarily Lived Apart From Husband

Three of the 16 married women stated that their participation in the program made it necessary for them to live apart from their husbands temporarily. All three were in the electrical engineering program.

Children's Feelings About Program Participation

The children's reaction to their mother's participation in the program ranged from strongly disapprove (one) to strongly approve (one). An equal number of the mothers (two) indicated that their children disapproved or did not care. The modal category (five) was "approve". One mother reported that her children strongly approved. All of the mothers said that the way their children felt at the time of the survey (near the end of the program) did not represent a change from the way they felt when their mother's were accepted.

The one instance of strong disapproval was reported by a mother enrolled in the electrical program of study. One mother in each program detected disapproval. There was also one case in each program of a mother's stating that the children did not care about her participating in the program.

Four of the mothers in the chemical program but only one in the electrical field of study sensed approval. The only mother who reported strong approval was in electrical engineering.

Financial Difficulty While in the Program

Fifty-eight percent of the women experienced either "some difficulty" (14 respondents) or "great financial difficulty" (7 respondents) during the program. Ten said they had not experienced "much difficulty", and five "no difficulty". Four of the seven who experienced "great difficulty", and three of the 14 who acknowledged "some difficulty" were in the chemical program.

We asked Fast Track students which of the following applied to them: (1) head of household; (2) contributed to financial support of family; (3) resided away from family; (4) husband relocated to facilitate participation in program. The responses obtained for all the Fast Track women (36), the 16 in chemical engineering, and the 20 in electrical engineering appear below.

	All Students Percentage/No.		Chemical Students Percentage/No.		Electrical Students Percentage/No.	
Head of Household	41.7	15	31.3	5	50.0	10
Contributed to Family Financial Support	8.3	3	6.3	1	10.0	2
Resided Away from Family	27.8	10	12.5	2	40.0	8
Husband Relocated	5.6	2	12.5	2	0.0	0

As may be seen above, 15 of the 36 women (41.7 percent) were heads of households. While about one-third (actually 31.3 percent) of those in chemical engineering were the heads of the household, one-half of the electrical engineering students were heading their households.

Three of the women were contributing to the financial support of their families. Two of the three were in the electrical engineering program.

Ten of the students (27.8 percent) resided away from home while participating in the program. A much larger percentage of the electrical engineering students lived away from home - 40 percent (8 students) compared to 12.5 percent (2 students) in the chemical track.

Two of the husbands (5.6 percent) relocated to facilitate their wives' participation in the program. Both of these men were married to women studying chemical engineering.

Outside Employment

Fourteen of the women had outside employment while participating in the program. Of this number, only four were from the Chemical Track. This represents one-quarter of the total number enrolled. On the otherhand, one-half (10 students) in the electrical program were employed.

Average Hours Worked Per Week

Overall, the 14 who were employed worked an average of 13 hours per week. The number of hours worked per week ranged from five to 24. The modal category consisted of four women who worked 15 hours per week. The women in the Chemical Track worked an average of 13.5 hours per week, and those in the electrical program 12.7 hours per week.

Importance of Job During Program

One-quarter of the women in the program stated that it was "very important" for them to have a job earning money while in the program. Six others (16.7 percent) said it was "important." Fifty percent indicated it was either "not important at all" (12 students) or "not very important" (6 students). More women in the electrical than the chemical program stated it "important" or "very important" to hold a job. We calculated the mean level of importance by assigning values of one to the "not important at all" response category, two to the "not very important," three to "neither important nor unimportant," four to "important", and five to "very important." The mean value for the women in the Chemical Track was 2.19, whereas, among those in the electrical program, since 55 percent said it was "important" (5 students) or "very important", the mean value was 3.35.

Extent To Which Selected Factors Were Helpful Or Detrimental During Participation

We asked the students to indicate the extent to which 11 different factors operated in either a helpful or detrimental way while they participated in the program. The questionnaire contained a 10-point continuum for each of the 11 factors. The tenth-point was labeled "helpful", the middle "not a factor," and the zero point "detrimental". When the scores corresponding to the number circled by the 36 students were analyzed they yielded the following mean values and rank order of "helpfulness".

	$\bar{x}$	Rank Order
Financial Situation	4.72	11
Study Habits	7.22	5
Personal Academic Ability	8.75	3
Reentry Into the College Environment	6.17	10
Husband's Support	9.14	1
Improved Job Prospects	9.00	2
Relations with Classmates	8.58	4
Family Relationships	6.83	7.5
Interactions with Faculty	6.83	7.5
Interactions with Program Staff	7.31	6
Child Care	6.36	9

The mean values for each of the 11 factors and their rank order of "helpfulness" as reported by the women in the chemical program are presented below:

	$\bar{x}$	Rank Order
Financial Situation	4.62	10
Study Habits	6.25	7
Personal Academic Ability	8.44	4
Reentry Into the College Environment	5.31	9
Husband's Support	9.22	1
Improved Job Prospects	8.56	3
Relations with Classmates	8.94	2
Family Relationships	7.38	5
Interactions with Faculty	5.80	8
Interactions with Program Staff	7.19	6
Child Care	----	--

When the mean and rank order values for the electrical students were calculated, the following resulted:

	$\bar{x}$	Rank Order
Financial Situation	4.80	11
Study Habits	8.00	5
Personal Academic Ability	9.00	3
Reentry Into the College Environment	6.85	9
Husband's Support	9.14	2
Improved Job Prospects	9.35	1
Relations with Classmates	8.30	4
Family Relationships	6.40	10
Interactions With Faculty	7.60	6
Interactions With Program Staff	7.40	7
Child Care	7.00	8

Have Done As Well As Expected

One question contained in the survey asked, "Have you done as well as you expected when you first entered the program?" Four of the women acknowledged that they had not done nearly as well as they thought they would. Another six disclosed that they had not done quite as well as expected. On the otherhand, 16 of the 36 (44.4 percent) had done as well as they thought they would. Among the chemical students, one-quarter (4) had not done nearly as well as expected, and another quarter had not done quite as well as expected for a total of half who had not met their own expectations. Only one person had done better than expected. Overall, more women in the electrical than the chemical program expressed they had done as well as (9 or 45 percent) or better than (9 or 45 percent) expected. In contrast to the chemical track participants, no one in the electrical track said she had not done nearly as well as expected.

Estimated Overall Grade Point Average

Estimates of overall grade point average ranged from 2.0 (3) to 4.0 (3). The mean value for the 36 women was 3.32. The chemical category which contained all of those estimating a 2.0 and only one of those expecting a 4.0 had a lower mean - 2.98. The range of estimated grade point averages for the electrical women started at 2.8 and ended at 4.0. Their mean value was 3.60.

Hours Per Week Spent On Homework

Thr 36 women in the program averaged about 27 hours per week spent on homework assignments. The amount of time spent studying ranged from three hours to 50 hours a week. The modal category for the women was 30 (11). Those in the chemical program averaged 29 hours a week, and those in the electrical 25.5 hours a week.

Study Habits While In The Program

None of the women described their study habits as "not good at all." However, an equal number (5) considered their study habits to be "not very good" or "neither good nor bad." The modal category was "good" study habits (15). The remaining 11 described their study habits as "very good." Calculating the mean using weighting factors of "very good" equals 5, "good" equals 4, "neither good nor bad" equals 3, "not very good" equals 2, and "not good at all" equals 1, the mean value was 3.89. The mean for the chemical was slightly below this (3.56). The electrical women, only ten percent of whom described their study habits as "not very good," had a mean value of 4.15.

Difficulty of Fast Track Program

When we asked the women how difficult the program has been, no one said "very easy" or "easy." Seven felt the program was "neither difficult nor easy." The modal category consisted of the 16 who considered the program "difficult." A comparison of the responses categorized by chemical or electrical program reveals that slightly more of those in chemical considered the program "very difficult" (44 percent) than those in the electrical program (30 percent). However, the mean values for the two groups are very similar - 4.19 for the chemical and 4.15 for the electrical.

Actual Versus Expected Difficulty

The questionnaire contained one item asking the students if they found the program to be more difficult, less difficult, or about as difficult as expected. A following question inquired of those who responded "more difficult" or "less difficult." How much more difficult (less difficult) the program was than expected. We were able to construct a new variable, degree of difficulty, based on the responses to these two questions. The results that the variable transformation process produced are presented below.

Degree of Difficulty	Percentage	Number
Much less difficult	0.0	0
Somewhat less difficult	11.1	4
Only slightly less difficult	0.0	0
About as difficult as expected	33.3	12
Only slightly more difficult	27.8	10
Somewhat more difficult	27.8	10
Much more difficult	0.0	0

$\bar{x} = 4.611$

As may be seen in the table below, only one of the chemical engineering students found the program somewhat less difficult than expected. Three of the electrical engineering students reported that they experienced less difficulty than expected. Whereas one-quarter of the chemical students stated that the program was about as difficult as expected, forty percent of the electrical engineering students made this statement. Six of the students in the chemical fast track (37.5 percent) found the program "only slightly more difficult" than expected. Only twenty percent of those studying electrical engineering were located in that response category. A higher percentage of the women in chemical engineering expressed the viewpoint that the program was "somewhat more difficult" than expected - 31.3 percent compared to 25 percent.

Degree of Difficulty	Chemical Students Percentage/No.		Electrical Students Percentage/No.	
Much less difficult	0.0	0	0.0	0
Somewhat less difficult	6.3	1	15.0	3
Only slightly more difficult	0.0	0	0.0	0
About as difficult as expected	25.0	4	40.0	8
Only slightly more difficult	37.5	6	20.0	4
Somewhat more difficult	31.3	5	25.0	5
Much more difficult	0.0	0	0.0	0
	$\bar{x}$ = 4.875		$\bar{x}$ = 4.400	

Educational Quality of Instruction

We asked students how they felt about the quality of education being provided by the instruction in the Fast Track Program. In order to calculate the mean, the following values were assigned to the response categories of this question: "very good" = 5, "good" = 4, "neither good"

nor bad" = 3, "not very good" = 2, "not good at all" = 1. The mean value for the responses of all the women was 3.5. This mean shows the "typical" respondent is located midway between "neither good nor bad" and "good." Five women thought the instruction was "not good at all". Eight, on the other hand, considered the instruction to be "very good". When we examined the responses of the chemical students we found the mean (2.44) to be considerably lower for this group than for the entire group. Closer inspection of the data revealed that all five of those who said the instruction was "not good at all" and all three of those who said "not very good" were enrolled in the chemical track. One-quarter thought the instruction was "neither good nor bad" and another quarter thought it was "good". None of the people studying chemical engineering thought the instruction was "very good." When we turned to the data collected from the electrical engineers we found that the lowest rating was one person who thought the program was "neither good nor bad". The remaining nineteen women in the program evaluated the quality of instruction as being "good" (11 students) or "very good" (8 students). Consequently, the median was a high value - 4.35.

Program Preparation For Thinking and Functioning As An Engineer

Two-thirds of the thirty-six women answered "yes" that the instruction had prepared them to think and function as an engineer. Ten responded that the program had not given them this preparation, and two said they "did not know" if the instruction had given them the engineering approach to problem solving. About ten percent differential appeared when we compared those in the chemical program answering "yes" with the responses obtained from all thirty-six women. Both of the women who replied they "did not know" if the program prepared them to think and function as an engineer were chemical engineering students. Seventy-five percent of the women in the electrical engineering program thought they were receiving instruction that equipped them with the engineering approach to problem solving.

Evaluating the Quality of Selected Aspects of the Program

We asked the students to rate the quality of ten aspects of the program. The rating scale was a five point continuum ranging from "very good" to "fairly good" to "average" to "not very good" to "not good at all." When we assigned values of 5, 4, 3, 2, and 1 to the preceding response categories the following mean values were calculated:

Program's Content	4.42
Program's Organization	4.17
Program's Overall Worth	4.42
Training in Engineering Theory	3.92
Experience in Engineering Applications	2.86
Faculty's Teaching Ability	3.06
Project Director	4.50
Project Staff	4.33
Professional Development Counseling	3.44
Personal Counseling	3.53

When we selected out those in chemical engineering and computed the weighted mean, we obtained the results shown below:

Program's Content	4.31
Program's Organization	4.00
Program's Overall Worth	4.31
Training in Engineering Theory	3.56
Experience in Engineering Applications	2.56
Faculty's Teaching Ability	1.81
Project Director	4.31
Project Staff	4.50
Professional Development Counseling	3.38
Personal Counseling	3.47

Examination of the rating responses of the electrical engineering students produced the following results:

Program's Content	4.50
Program's Organization	4.30
Program's Overall Worth	4.50
Training in Engineering Theory	4.20
Experience in Engineering Applications	3.10
Faculty's Teaching Ability	4.05
Project Director	4.65
Project Staff	4.20
Professional Development Counseling	3.50
Personal Counseling	3.58

On the surface it appears that the students in the Chemical Track felt that the quality of instruction from the Chemical Track was not as good as that from the Electrical Track. However, this reaction may have been related much to the style of instruction as to who was giving it. The transitional approach used by the electrical engineering faculty definitely produced more positive results. However, in reviewing what some of the chemical students have been able to accomplish on the job, it appears these students are very well prepared. Preparedness, however, does not necessarily produce positive faculty evaluations.

It is also interesting to note that the more negative faculty evaluations from the Chemical Track seemed to come from the teachers, and the teachers who were older. These students perceived that the style of teaching being used was "not innovative" and not what they agreed with, and therefore, not up to their standards. They were much less tolerant of faculty deficiencies more routinely tolerated by undergraduate students.

Accessibility of Instructors For Academic Counseling

In this survey we also asked the students to indicate the accessibility of their instructors. Of the 35 women who sought academic counseling, 25 percent (9) replied their teachers were "readily" accessible. The modal category was "usually" accessible (23 students). None of the women said their instructors were "seldom" or "never" accessible for academic counseling. The lowest rating among the chemical students was supplied by one women who reported the instructors were "occasionally" accessible. Of the remaining 15, nine responded the faculty were "usually" accessible and six answered "readily" accessible. Two of the 19 electrical engineering students who sought academic counseling said the instructors were "occasionally" accessible. Nearly 75 percent (14) thought the faculty was "usually" accessible, and three others stated they are "readily" accessible.

Lecture Or Self-Paced Format

We are interested in determining if students preferred courses in which a lecture format or a self-paced format is used. The lecture format was preferred by 22 while seven preferred a self-paced format. Seven students replied that they had no preference. Some differences in preference existed when we analyzed the data by type of program. Seventy-five percent of the chemical students preferred the lecture format whereas only 50 percent of those studying electrical engineering did. The biggest difference between the two groups was that more in the electrical (6) than the chemical program (1) did not have preference for class format.

Class Mix

About 42 percent of the students (15) had no preference between attending classes that contain Fast Track and undergraduates or classes that

contain only Fast Track students. Sixteen or 44 percent preferred attending classes that had a combination of the two groups. One-half of the women in the chemical program had no preference. The remaining 50 percent was equally divided between having Fast Track and undergraduates and only having Fast Track students in their classes. When we analyzed the responses from the electrical engineering students we found a majority (60 percent) preferred attending classes containing both groups, one person wanted only Fast Track students in her classes, and seven had no preference.

Likelihood Of Entering Fast Track Again

We asked the students the question "if you could do it over again, how likely is it that you would enter the Fast Track Program?" Two stated it would be "very unlikely". No one said "unlikely." Two others replied "neither likely nor unlikely." Seven women responded "likely." The largest category, "very likely" consisted of 25 women. The two women who thought it was "very unlikely" along with the two who said "neither likely nor unlikely" were all enrolled in the chemical program. An equal number, six, replied they would be "likely" or "very likely" to enter. All of the women in the electrical program except one thought it would be "very likely" that they would enter Fast Track again. The one woman not in the "very likely" category did say "likely."

Likelihood Of Entering Fast Track If Tuition ($4,075) Were Charged

When we asked if they would enter Fast Track if tuition ($4,075) were charged, 16 said it was "not at all likely." Twelve others replied "not very likely." Only two thought it would be "very likely." Six others answered "likely." Twenty-five percent of those in the chemical program

said it would be "likely." The remaining 75 percent consisted of seven "not at all likely" and five "not very likely" respondents. Eighty percent of those in the electrical engineering program were contained in the "not at all likely" (9 students) and the "not very likely" (7 students) categories. Both of the women who indicated it was "very likely" that they would enter the program if charged tuition were studying electrical engineering.

Willingness To Pay Tuition To Attend Program

We posed a follow-up question to the 28 students who indicated that they were "not very likely" (m=16) or "not at all likely" to pay a tuition of $4,075. The addiitonal question specified six other lower tuition rates and asked which of these they would be willing to pay. The results are presented below:

	Yes	No
$3,500	3.6% (1)	96.4% (27)
$3,000	7.1% (2)	92.9% (26)
$2,500	7.1% (2)	92.9% (26)
$2,000	25.0% (7)	75.0% (21)
$1,500	39.3% (11)	60.7% (17)
$1,000	75.0% (21)	25.0% (7)

The one student expressing a willingness to pay a tuition of $3,500 was in the electrical engineering program. One student in each program was willing to pay $3,000 in tuition. There was no increase when the tuition figure was reduced to $2,500. The two who indicated they would pay $3,000 were the only students willing to pay $2,500. Four of the 12 chemical

engineering students who answered this question were willing to pay $2,000 in tuition. Three of the 16 electrical engineering students who responded to this question said they would pay $2,000 to enroll in the program.

Best Descriptive Statement

We asked each student which of the three following statements best describes her:

1. I am most comfortable when I can solve a technical problem and get the best answer in the shortest amount of time.
2. I am most comfortable when I can solve a technical problem in great detail with time not being a factor.
3. I am most comfortable when I can solve problems that deal with people rather than technical problems.

One-half of the thirty-five students replying to this question selected the first statement as best describing them. Fifteen women (41.4 percent) found the second statement the one that best characterized them. Only two felt most comfortable solving problems dealing with people rather than technical problems.

The ratio of women in the chemical program who considered statement one more appropriate than statement two was two to one (62.5 percent compared to 31.3 percent). Among those in the electrical program, the split was much closer with the second statement being chosen more often than the first (52.6 percent versus 42.1 percent). Of the two women who are most comfortable solving people problems, there was one in each of the programs.

Obtaining Engineering Degree Importance

Twenty-one (80.6 percent) of the students indicated that it was very important to obtain the engineering degree. Five others thought it was important. Two responded that it was neither important nor unimportant. None of the women considered receiving the degree as "not very important" or "not important at all." All of the chemical engineering students were located in the "important" (2) and "very important (14) categories. Both of the women who felt that it was neither important nor unimportant were enrolled in the electrical program. Three-quarters of those in the electrical Fast Track regarded earning the degree as very important. The remaining fifteen percent looked upon obtaining the degree as important.

Importance of Good Grades For Desired Engineering Position

Nearly seventy percent of the students thought that good grades would be important (41.7) or very important (27.8 percent) in order to get the engineering position that they would like to have in the future. The next highest category consisted of 19.4 percent who felt that good grades were neither important nor unimportant. Three of the women held the opinion that good grades were not very important. One student out of the thirty-six expressed the viewpoint that good grades were not important at all to secure the engineering position she desired.

Importance of Engineering Degree For Future Job

For twenty-three of the students (63.9 percent) it is "very important" to complete the engineering degree in order to obtain the kind of job they would like to have in the future. The next highest category consisted of eight women who responded "important." Three considered (8.3 percent)

receiving the degree "neither important nor unimportant" and two regarded it as "not very important" (5.6 percent) as a basis for attaining the job they desire in the future. No one took the position that the degree was "not important at all". The mean value on the five-point scale ranging from "not important at all" to "very important" was 4.44.

One of the two students in the "not very important" category was from each program. The two chemical engineering students who indicated that it was "neither important nor unimportant" represented 12.5 percent of the total number in that program. The one electrical engineering student comprised five percent of that group. Twenty-five percent of those in the chemical and 20 percent of those in the electrical program valued the degree as an important foundation for the position of the future. Of the 23 who viewed the engineering degree as being "very important" nine (56.3 percent) were in the chemical and 14 (70 percent) in the electrical group. The mean for the chemical students was 4.31. The value for the electrical students was slightly higher, 4.55.

Obtaining Engineering Degree Versus Seeking Employment

One-half of the women said they intended to obtain their engineering degree first and then seek employment. Eight (22.2 percent) planned to obtain a job first and then finish their degree. The 10 remaining students desired to simultaneously work on earning the degree and perform on the job. Seven of those in chemical engineering preferred to delay seeking employment until after securing the engineering degree. Seven also chose to reverse the order by first gaining employment and then completing the degree. Only two expected to study for the degree and work at the same time. Among those in electrical engineering, 55 percent wanted to acquire the degree before

seeking employment. Forty percent (8 students) wished to do both at once. One student (5 percent) was bent upon working first.

Understand What A Chemical Engineer Does

Of the 35 students who answered the question "How well do you understand what a chemical engineer does?", 11 acknowledged, "not very well." All 11 were enrolled in the electrical program. Fifteen (41.7 percent) reported that they understood fairly well. Eight of these were in the electrical program. The seven who replied "very well" and the two who considered their understanding to be in the "extremely well" level were studying chemical engineering.

Understand What An Electrical Engineer Does

The questionnaire also contained an item asking the students how well they understood what an electrical engineer does. As could be expected, all five women whose understanding was in the "not very well" category were in the chemical engineering group. Nine of the 16 who thought their understanding was in the "fairly well" range. All but one of the 11 women who indicated "very well" were in the electrical program. The three who placed themselves in the "extremely well" category were in the electrical engineering program.

Engineering Job Skills Comparison

We listed five engineering job skills (knowledge of engineering theory, ability to apply engineering knowledge, mathematical skills, computer skills, and laboratory or hands-on skills) and asked the Fast Track students to compare their skills with those of students completing the traditional engineering program. The response categories were "much better," "better,"

"about the same," "worse," and "much worse." (1=much worse, 5=much better). The computer mean values for the 36 chemical and electrical students are displayed below.

	All Students	Chemical Students	Electrical Students
Knowledge of engineering Theory	3.66	3.87	3.50
Ability to Apply Engineering Knowledge	3.57	4.07	3.20
Math Skills	4.43	4.20	4.60
Computer Skills	3.17	2.87	3.40
Laboratory Skills	2.69	3.47	2.10

As may be seen above, laboratory skills were the only job skill area on which the mean value is below three (the value assigned to "about the same".) A majority of the Fast Track students feel their laboratory skills are "worse" (13 students) or "much worse" than the traditional students. However, there is a difference between the two groups of students. The chemical students are more confident of their laboratory skills - only three, or 20 percent responded "worse" (no one said "much worse".) Among the electrical students, 75 percent regarded these skills as "worse" (25 percent) or "much worse" (50 percent.)

The only other instance in which a mean value of less than three occurred was among the chemical engineering students when we asked about computer skills. Eight of the 15 women answering this item were located in the "worse" (7) or "much worse" (1) categories.

How Marketable Are Job Skills?

When we asked the students how marketable they thought their job or career skills were no one replied "not at all marketable." One person thought she was "not very marketable" and three others were "not sure how marketable" they were. Two-thirds or twenty-four women thought they were "very marketable." The mean value on the five point scale that extended from "not at all marketable" to "very marketable" was 4.53. The women who replied "not very marketable" and the three "not sure" were all in the chemical program. An equal number (6) of these women considered their job or career skills "marketable" or "very marketable." All of the women in the electrical engineering program thought their skills were "marketable" (ten percent) or "very marketable" (90 percent). The mean value for these women was 4.90.

Willingness To Relocate For Job

Twenty-five of the thirty-six women indicated that they would be willing to relocate for a job. One-quarter were not willing and two (5.6 percent) did not know if they were willing. While half (8) of those in chemical engineering were willing to relocate, 85 percent (17) of those in electrical were. Both of the "do not knows" were in chemical engineering. These two women comprised 12.5 percent of the total number in the chemical program.

Number of Job Interviews

All of the women in the program had at least one job interview at the time they participated in the survey. One student reported being interviewed thirty times. The modal category was ten interviews and the mean number of interviews was twelve. The two women who were at the extreme ends of the range were in the chemical program. The mean number of job

interviews (12) was the same for students in both programs. An equal number of students in the electrical program had eight, ten, and 20 interviews. Each of these three categories accounted for 20 percent of the women who completed the electrical program.

Job Interview Preparation

Responses to the question "How well did the Fast Track Program prepare you for these job interviews?" yields the following results:

Not Very Well	0	0.0%
Fairly Well	14	38.9%
Very Well	14	38.9%
Extremely Well	8	22.2%
Total	36	100.0%

$\bar{x} = 2.83$

Eight of the 14 in the "fairly well" category were in chemical engineering. This comprised 50 percent of those in the chemical program. Six felt they had been "very well" prepared for their job interviews. Two judged that they had been extremely well prepared.

The modal category for the electrical engineering students consisted of eight who thought they were "well prepared". Thirty percent perceived the program as preparing them "fairly well. Thirty percent also evaluated their level of preparation as being "very well."

Expected Starting Salary

All of the women in the study provided us with data when we asked what starting salary they would be offered as an engineer. The distribution of salaries ranged from $10,000 to $25,000. The modal category was located at

$20,000, the salary at which nine students expected to start. The mean anticipated starting salary was $20,714. The range of expected starting salaries was narrower for those in the chemical program - $10,000 to $22,000. Five of the women in the electrical program expected to be offered more than $20,000 as a starting salary. The modal category was $20,000 and the mean salary was $19,544 for the chemical students. The expected starting salaries of the electrical students assumed the form of a trimodal distribution. Four students were located were located at each of the following: $20,000, $21,000, and $22,000. The mean expected starting salary for this group was $21,650.

Estimated Salary Five Years From Now

Thirty-five of the 36 women in the study estimated the salary they thought they would be earning in 1985. The salaries ranged from $21,000 to $50,000. The modal category of $30,000 consisted of eight students. The mean salary they expect to be receiving is $31,743. Among the women in the chemical program, the mean salary was slightly lower than the overall mean for the 35 students who completed the program. The lowest ($21,000) and the highest ($50,000) salaries were those expected by women in the chemical engineering program. The modal category for the chemical students was $30,000, the same amount that it was for all the members of Fast Track I. The range of anticipated salaries - $24,000 - $40,000 was narrower for the electrical students than it was for the chemical engineering women. The modal category of $35,000 (five students) and the mean expected salary of $32,789 were higher for the electrical group.

Summary profiles of the participants of Fast Track I and I follow:

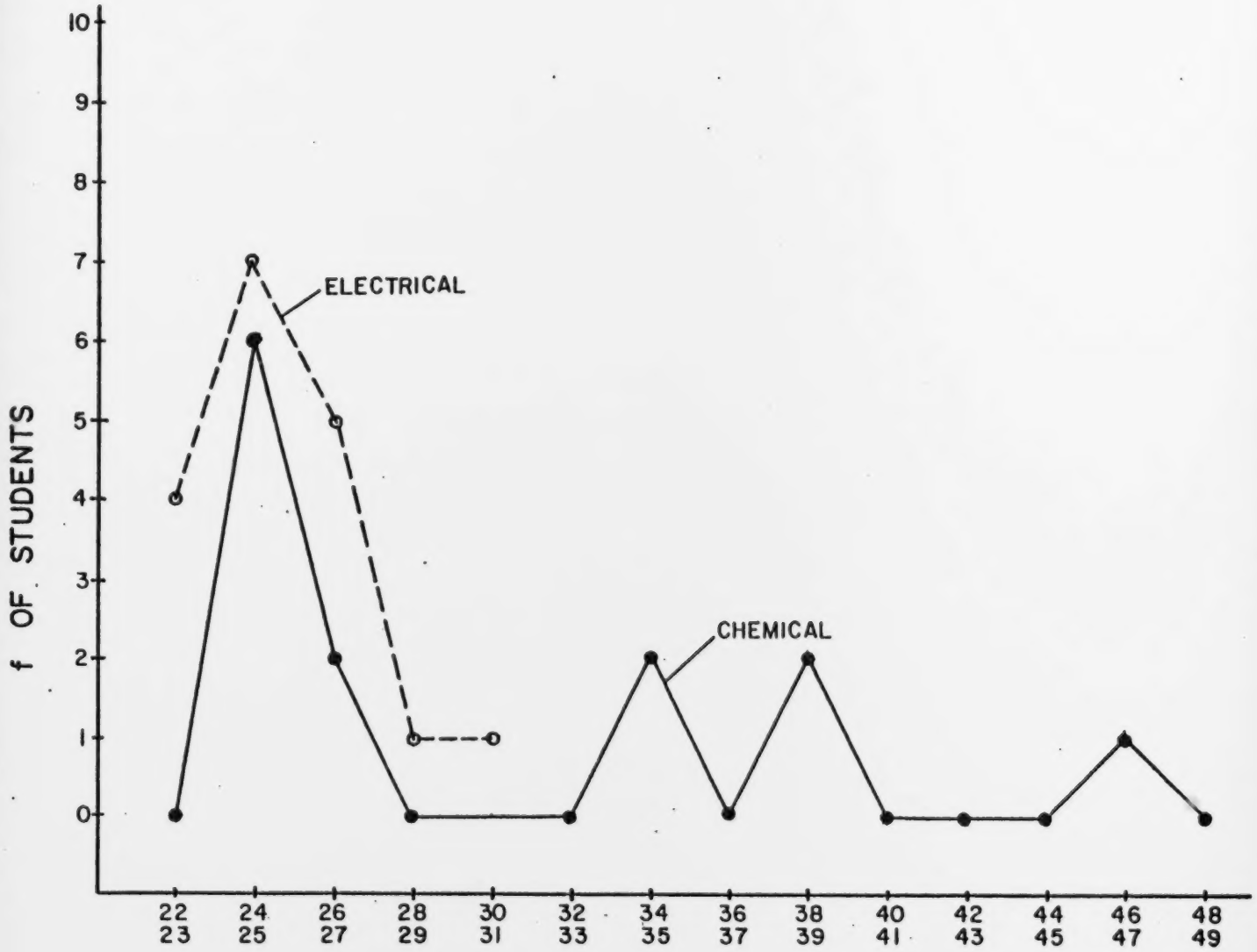


FIGURE I. AGE DISTRIBUTION OF FAST TRACK ELECTRICAL AND CHEMICAL STUDENTS.

SUMMARY PROFILE - CHEMISTRY

Age	Minority Status	DEGREE		AREA(S)	WORK EXPERIENCE		
		BA/BS	MS	Major Minor	Teaching	Science-Specific	Non-Specific
26	Caucasian	X		Chemistry	X	Four years' experience in air quality control and stack sampling	
47	Caucasian	X	X	BA in Chemistry; Biology and Math minors. MS in Chemistry		Seven years' employment as Associate Editor for Chemical Abstract Service, abstract, paraphrase, edit.	
39	Caucasian	X		Chemistry; Math and Physics minor	17 years' teaching experience post-BA		
39	Caucasian	X	X	Chemistry; Math minor Science Ed., Geology and Zoology	8 years' experience in college teaching		
34	Afro-American	X	X	Microbiology; Chemistry minor Journalism; bio-chemistry minor		College administration for minorities in Engineering; supervisor of 9-11 chemists; Scientific reviewing, indexing.	

SUMMARY PROFILE - CHEMISTRY

Age	Minority Status	DEGREE		AREA(S)	WORK EXPERIENCE		
		BA/BS	MS	Major Minor	Teaching	Science-Specific	Non-Specific
25	Caucasian	X		Mathematics; minor in General Science		Three years' experience in engineering technology, piping design and computer isometrics	
24	Caucasian	X		Natural Resources		Two and one-half years' experience as environmental planner	
25	Caucasian	X		Chemistry; Math minor		Operational control analysis, assistant lab manager and chemist	
25	Caucasian	X		Medical Technology		Three years in Medical Technology	
25	Caucasian	X	 X	Math, French with German minor Math	Two yrs. experience High School teaching and part-time college teaching		

SUMMARY PROFILE - CHEMISTRY

Age	Minority Status	DEGREE		AREA(S)		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Science-Specific	Non-Specific
35	Afro-American	X	X	Chemistry, Math minor Organic Chemistry			Research Chemist; free lance writer. Seven years employment as Assoc. Editor for Chemical Abstracts Service, abstract, paraphrase, edit.	
27	Caucasian	X		Education in biological science; psychology minor- Cum Laude Graduate work in organic chemistry and microbiology		High School biol. and chem. in Singapore	Research Analysis	Patient service liaison; credit counselor; medicare, and insurance advisor.
25	Caucasian	X	X	Biology with Chem. minor Genetics with tissue biology minor		Two yrs. College teaching experience	Laboratory technician in biology lab.	

SUMMARY PROFILE - ELECTRICAL

Age	Minority Status	DEGREE		AREA(S)		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Math Specific	Non-Specific
26	Caucasian	X		Physics			Bookkeeping - one and one-half years' experience	
			X	Additional course work in accounting and insurance				
25	Caucasian	X		Math, education and Spanish	minors	Peace Corps in Zaire, Africa	Three years' experience in bookkeeping, as accounting clerk, computer programming	
23	Caucasian	X		Math and Computer Science				
			X	MBA			Scientific Programmer	
25	Caucasian	X		Math, Economics minor; graduated with honors		Two years' experience as high school math teacher		

SUMMARY PROFILE - ELECTRICAL

Age	Minority Status	DEGREE		AREA(S)		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Math Specific	Non-Specific
25	Caucasian	X		Math; statistics and computer science minors			Administrative assistant; record keeper, wrote and closed loans, loan teller for bank	
27	Caucasian	X		Math; additional training in Programmer Training, life insurance, law, economics, accounting			Two and one-half years as Programmer with finance company, one year as programmer for Systems and Computer Technology	
23	Caucasian	X		Math; psychology minor			Two years experience in accounts payable as calculator operator	
24	Caucasian	X		Math; additional course work in supervision training technical supervisors. Statistics and quality management			Two-and one-half years experience in quality costs and management reports.	

SUMMARY PROFILE - ELECTRICAL

Age	Minority Status	DEGREE		AREA(S)		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Math Specific	Non-Specific
27	Caucasian	X		General Science			Two years' experience as inventory clerk, computor operator	
25	Caucasian	X		Math; Summa Cum Laude		Junior High Math	Three years' experience in inventory control; factory work; and accounting	
23	Caucasian	X	X	Math M. E. D. in math; education minor		Junior High Math		Title Clerk for Ford distributor
25	Caucasian	X		Math; French minor		Math	One and one-half years' experience as Material Control Officer (USAF) to provide supplies for maintenance (as AF Officer)	
26	India-Indian	X	X	Math; physics and statistics minor Math; complex variable theory of waves		Volunteer tutor in Science and languages		

SUMMARY PROFILE - ELECTRICAL

Age	Minority Status	DEGREE		AREA(S)	WORK EXPERIENCE		
		BA/BS	MS	Major Minor	Teaching	Math Specific	Non-Specific
26	Caucasian	X		Math			One and one-half years' experience as cook and cashier
30	Caucasian	X		Physics; math minor			Four years' experience in various part-time and temporary jobs including engr sales assistant
29	Afro American	X		Math; biology minor Graduate math courses	Seven years' experience in High School Math		
23	Caucasian	X		Math major; sociology minor honor student		Two years experience as acturial assistant	
25	Caucasian	X		Math; Computer Science		Two and one-half years as computer programmer since college graduation	

SUMMARY PROFILE CHEMICAL TRACK II

Age	Minority Status	DEGREE		FIELDS	WORK EXPERIENCE		
		BA/BS	MS	Major Minor	Teaching	Science-Specific	Non-Specific
40	Caucasian	X		Math 1960 Latin & French Minor	3 years, secondary school math	Computer Programmer 3 years	Research Assistant, 2 yrs. Editorial Assistant, 3 yrs. Firefighter & Emergency Squad, 6 yrs
29	Caucasian	X		Chemistry 1975 Physics & Biology Minor		Science Lab Technician, 4 years	
29	Caucasian	X		Biology/Chemistry 1972		Bacteriology Technologist, 1 year Research chemistry 3 years	
44	Caucasian	X	X	Chemistry/Math 1956 Chemistry 1963		Quality Control Chemist, 1 year	Housewife, 13 years
36	Caucasian	X		Chemistry 1964 Math/Theology Minor		Lab Technician, 3 mos. Chemist, food & drug- 1 year metabolic disorders - 2 years research - 1 year	Housewife/ mother - 10 years

SUMMARY PROFILE CHEMICAL TRACK II

Age	Minority Status	DEGREE		FIELDS	WORK EXPERIENCE		
		BA/BS	MS	Major Minor	Teaching	Science-Specific	Non-Specific
35	Caucasian	X 1977		Chemistry Biology & Math Minor		Research Assistant in Biochemistry, 1 year Researcher & Lab Technician, 9 yrs. Medical researcher 2 years	
28	Chinese	X 1974	X	Chemistry Organic Chemistry		Research technician, 1 year Research chemist, 1 year	Assistant Manager in store, 1 yr.
24	Caucasian	1977 X		Math Physical Ed. Minor	2 years high school math teacher		Key punch Operator
27	Caucasian	X 1975		Chemistry		2 years as a junior research chemist for Mathey-Bishop Inc. New process development	1 year as a clerk in family business.
28	Oriental	X 1972		Chemistry Math and Physics Minor		Research in biochemistry. Senior night technician at Bethesda Hosp. Pathology Lab	

SUMMARY PROFILE CHEMICAL TRACK II

Age	Minority Status	DEGREE		FIELDS	WORK EXPERIENCE		
		BA/BS	MS	Major Minor	Teaching	Science-Specific	Non-Specific
35	Caucasian	X 1966	X 967	Chemistry	11 years as a teacher of H.S. Science & Math		
32	Caucasian	X 1969	X 1973	Chemistry Math Minor	7 years	H.S. Chemistry Teacher	
24	Caucasian	X 1977		Biology Chemistry Minor		2 years chemical research technician for Mead Central Research	
40	Caucasian	X 1960	X 1975	Chemistry Math/Physics	Junior High Science Teacher, 3 Years.		
36	Caucasian	X 1964		Math Ec. Minor			Census Taker
31	Caucasian	X 1975		Elementary Education	2 years science at elementary level		

SUMMARY PROFILE ELECTRICAL TRACK II

Age	Minority Status	DEGREE		FIELDS	WORK EXPERIENCE		
		BA/BS	MS	Major Minor	Teaching	Science-Specific	Non-Specific
24	Caucasian	X 1977		Physics			Course Developer for Bell Systems, 2 years
38	Caucasian	X 1968 X 1968	M.A 1975	Applied Math Chemistry Minor Physics, Chemistry Minor French	Math, secondary, 4 yrs substitute, 2 yrs. College math 2 yrs. French-College 1 year		
24	Caucasian	X 1977		Physics Math Minor		Engineering Aide, 3 months Computer Programmer 2 years	
39	Caucasian	X 1962	X 1969	Physics, Math Minor Math	Jr. High - 2 yrs. Elem. 1 yr. High school chemistry & physics 6 yrs. College math 3 yrs.		
24	Caucasian	X 1977		Math/Psych. Ed. Minor			Hotel Desk Clerk (nights) 1 year

SUMMARY PROFILE ELECTRICAL TRACK II

Age	Minority Status	DEGREE		FIELDS		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Science-Specific	Non-Specific
26	Caucasian	X 1975		Physics	Liberal Arts Minor	Teaching Associate, 9 months College Physics, 5 months		Clerical 1 month Food coop coordinater 5 months
30	Caucasian	X 1971	MAT 1974	Math	Philosophy Minor Math	H.S. math 7 yrs. Jr. High math, 1 yr.		(UFW) United Farm Workers Organizer, 3 mo. Tutor, volunteer inner city H.S.
29	Caucasian	X 1974		Physics				Patent examiner & classifier, 3 yrs. Full time babysitter, 2 yrs.
27	Caucasian	X 1974		Math		Peace Corp. Math teacher 2 yrs. Elem. math 1½ yrs.		Seamstress - 6 months Part-time apt. painting, secretary, waitressing, 4 months Janitor for Greyhound, 2 yrs.

SUMMARY PROFILE ELECTRICAL TRACK II

Age	Minority Status	DEGREE		FIELDS		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Science-Specific	Non-Specific
33	Caucasian	X 1968	X 1971	Math Math		H.S. Math Teacher - 11 years		Director of Physical Fitness, Part-time 1 year
27	Caucasian	X 1973	X	Math P.E. Minor Math P.E. Minor		Math Teacher and Dept. Chairman Secondary Schools, 6 yrs.		Assistant in personnel office doing statistical studies
26	Caucasian	X 1975		Math English Minor			Programmer/Analyst First National Bank of Boston	Bank Teller 1975-76
29	Caucasian	X 1972		Math				Technical writer for NCR, 2 years Program analyst for C.P.A. Editor Programmer for Sears
28	Caucasian	X 1973		Math			Senior Math aide and Mathematist for Aerospace Corporation 1975-79	

SUMMARY PROFILE ELECTRICAL TRACK II

Age	Minority Status	DEGREE		FIELDS		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Science-Specific	Non-Specific
27	Caucasian	X 1974	X 1977	Math Library Sci.				Insurance Underwriter 1974-75 Library Clerk
26	Caucasian	X 1974		Math				Sales cashier Contract Specialist at DESC, Dayton, 2 yrs. Air Traffic Control Specialist, 3 yrs.
31	Caucasian	X 1970		Math			Computer Programmer at WPAFB 1970-74	
		X 1967	X 1969 X 1971	Physics Physics Ed. Math Minor		Teaching asst. at OSU 1967-69 Sub. teacher Secondary teacher in Science for 6 months		Accountant 1972-79

SUMMARY PROFILE ELECTRICAL TRACK II

Age	Minority Status	DEGREE		FIELDS		WORK EXPERIENCE		
		BA/BS	MS	Major	Minor	Teaching	Science-Specific	Non-Specific
25	Caucasian	X 1976		Math	French Minor		Computer programmer for NCR 3 years	Custodial Worker 6 months
28	Caucasian	X 1973		Math	Eng, Ed. Minor	3 years, substitute teacher		Secretary, YMCA Clerk, IRS Service Rep-Social Security Adm. Ward clerk Veterans Medical Center

SECTION 7

THE CURRICULUM

Designing the Curriculum

The curriculum of the Fast Track program was developed by the chemical and electrical engineering department faculty and was reviewed and discussed during its developmental stages by the Academic Committee of the School of Engineering. Ultimately, both this committee and the Dean approved the curriculum. In addition, a Fast Track Committee was formed consisting of the project director, program evaluator, department chairmen in engineering and the chairman of mathematics. This committee met to establish schedules, and verify that each three hour course offered in a condensed term had the same number of contact hours as a three-hour course offered in the regular undergraduate school.

The Chemical Curriculum

The chemical engineering curriculum was based upon the design of the Monsanto Retraining Program in which the University of Dayton contracted to retrain 27 chemists and physicists (all male) from the Monsanto Mound Laboratories to function as chemical engineers. The Chemical Engineering Department chose to use the traditional lecture format for most of the basic instruction which followed that of the regular undergraduate curriculum. Graduate and undergraduate tutors were used as auxiliary aids in completing the educational sequence by acting as instructors during additional problem sessions. The Chemical Engineering Department also used seven week summer school terms for some courses in order to provide a mechanism for moving through sequential courses in a short time period. Other more difficult

courses were offered during a regular 15-week term to provide less course work per unit of time in order to facilitate integration of the course information.

The Electrical Engineering Curriculum

The Electrical Engineering Department used a self-paced learning process as one of the primary methods of instruction and completed the learning sequence by using discussions, problem solving, and short lectures to explain the more difficult concepts. Self-paced instruction was the primary method of instruction during the student's first term and was directed to the transitional approach. The Electrical Engineering Department believed that the self-paced learning approach, which permits a more informal and at the same time more academically intense interaction between student and instructor, would be particularly important in the Fast Track Late Entry Program because of the variation in individual backgrounds of the program participants. The final courses in electrical engineering were designed to tie together the various electrical engineering disciplines. An outline of the chemical and electrical curriculum is presented in Table 5.

In Fast Track II, however, we continued to observe that participants in the chemical track, which utilized the traditional classroom techniques as their only methodology, required more counseling and support services. When we asked students in Fast Track II to indicate the extent to which different factors operated in either a helpful or detrimental way (the tenth point was labeled helpful, the middle not a factor, and the zero point detrimental), students in the electrical track rated reentry into the college environment more positively (6.85) than did the women in the chemical track (5.31). This seemed to indicate that a transitionary approach such as a self-paced

TABLE 5

FAST TRACK II CURRICULUM*

Chemical

Term Length In Weeks	Courses	Cr. Hr.	Title
7	MTH 490	3	Special Topics in Mathematics
7	CME 203	3	Materials and Energy Balances
7	MTH 219	3	Applied Differential Equations
7	CME 305	3	Thermodynamics
3	EGR 399	1/2	Career Education Course
12	ELE 321	3	Basic Electric Theory I
12	CME 306	3	Kinetics †
6	CME 324	3	Transport Phenomena I
6	CME 325	3	Transport Phenomena II †
3	EGR 399	1/2	Career Education Course
3	MTH 490	1	Problems in Partial Diff. Equ.
12	CME 413L	2	Unit Operations Laboratory
12	CME 452	3	Process Control I
6	CME 411	3	Unit Operations I
6	CME 412	3	Unit Operations II
6	CME 430	3	Chemical Engineering Design

Electrical

7	ELE 499	2	S.P. Circuit Analysis*
15	ELE 499	3	S.P. Field Theory*
15	EGM 499	3	S.P. Mechanics/Dynamics
7	ELE 499	2	S.P. Electrical Devices*
7	ELE 499	1	S.P. Circuit & Instrumental Lab
3	EGR 399	1/2	Career Education Course
7	ELE 312	3	Engineering Electron †
15	ELE 332	3	Circuit Theory IV †
7	CME 305	3	Thermodynamics
15	ELE 431	3	Energy Converation †
	or ELE 334	3	Field Theory III †
15	ELE 499	1	S.P. Electronic System Lab
3	EGR 399	1/2	Career Education Course
12	ELE 413	3	Communication Engineering †
12	ELE 531	3	Digital Systems †
12	ELE 432	3	Auto. Control System †
12	ELE 499	1	S.P. Electrical System Lab

† Integration with undergraduate students occurs here.

* Self-Paced

S.P. = Special Problems

methodology is a particularly successful methodology for the early stages of a reentry program.

Student Reaction to Methodology

We were interested in determining if students preferred courses in which a lecture format or a self-paced format is used. We were surprised to find that even though the traditional lecture format seemed to produce test anxiety and other symptoms of "academic stress", 22 of the 36 women completing the second Fast Track program indicated they preferred the lecture format while seven students preferred a self-paced format. Another seven students, six in the electrical track and one in the chemical track indicated they did not have a methodology preference. However, it is also interesting to note that the faculty using only the traditional lecture technique received a lower overall rating (5.80) than faculty using a mixed self-paced and lecture approach (6.83). The scale was based on the tenth point helpful, the middle not a factor, and the zero point detrimental.

Even though the different teaching methodologies produced different reactions from the students, both chemical and electrical faculty felt that their approach had advantages. In Fast Track I there was an indication that the longer-range effect of the traditional approach was to produce participants that felt slightly more self-confident. We hypothesized that the strong competition in the classroom reinforced feelings of success. In the Fast Track II we asked participants to compare their skills with those of students in the undergraduate program on five engineering job skills. The response categories were: (5) much better, (4) better, (3) about the same, (2) worse, (1) much worse. The students in the chemical track which used only the traditional lecture technique indicated more confidence in their abilities

on three out of the five areas, knowledge of engineering theory, ability to apply engineering knowledge, and laboratory skills. The two areas students in the electrical track appeared more confident, math skills and computer skills were predictable due to the mathematics and computer background the participants in the electrical track had when they entered the program.

These results seem to indicate that a combination of methodologies is appropriate. A reentry program that begins with self-paced modules provides for a smoother transition back into the academics, and integration with undergraduate students in a traditional classroom atmosphere, provides the opportunity to compare academic performance, and builds self-confidence.

Student Performance in Fast Track: Evolvement of a Second Degree Program

At the time we initiated the Fast Track program, we had no idea how students with bachelor's degrees in science and mathematics would perform in an intensive engineering program. However, it became immediately apparent that Fast Track students were, in effect, graduate students enrolling in an undergraduate program. Their next educational step would normally be a master's degree and their educational maturity was at the master's degree level as they entered the Fast Track program. In fact, 22 of the 71 students in the two NSF sponsored programs had master's degrees when they entered the program.

Evaluation of student performance by the teaching faculty indicated that the Fast Track students were easily able to adapt and perform in our regular upper level engineering courses. Evaluation of the capabilities of the students in the Monsanto and NSF sponsored Fast Track programs were such that early in the first Fast Track program we expanded to 30 credit hours the basic 26 credit hour package first conceptualized as the right number

of courses to offer in a Fast Track program. We feel that 30 hours constitutes a core curriculum in a Fast Track program and we award a certificate of completion to anyone who finishes the 30 hours of core courses.

We evaluate the performance of Fast Track students and regular undergraduates on common examinations and in common classes and these student evaluations were analyzed by our program evaluator. The Fast Track students consistently performed at an equal or higher level than undergraduate students. Table 4 is a comparison of Fast Track performance of the students in the chemical track on two thermodynamics exams and Table 5 is a comparison of Fast Track and senior performance on a common final exam designed as a general comprehensive exam for both groups.

The faculty found the range of test score performance narrower for Fast Track students with a higher level of academic performance. However, the good academic performance of Fast Track students is not surprising when we consider their academic capabilities, high motivation, and maturity factors.

The quality of the students and evaluation of the program affected the ultimate development of the curriculum of the program. After we evaluated the performance of Fast Track I students in identical courses, with identical examinations, in classes taught by the same regular, full-time faculty, we increased the number of credit hours offered in a Fast Track program to 36. We announced the possibility that students could obtain a second degree if they also fulfilled other engineering and university degree requirements.

Most universities have similar options for obtaining a second degree. However, the Fast Track program builds upon the concept that incoming participants are at about the same basic academic level. The program, therefore, provides a mechanism for offering the basic core requirements for a second degree in an identifiable and marketable package.

TABLE 6

A COMPARISON OF
FAST TRACK AND SENIOR EXAMINATION SCORES

Problem	Fast Tract N = 9 # Correct	%	Seniors N = 19 # Correct	%
1.	6	66.7%	8	42.1%
2.	8	88.9	13	68.4
3.	5	55.6	4	21.0
4.	1	11.1	7	36.8
5.	4	44.4	8	42.1
6.	6	66.7	4	21.0
7.	2	33.3	4	21.0
8.	2	33.3	4	21.0
9.	0	0.0	3	15.8
10.	2	33.3	11	57.9

Fast Track - Higher on seven (#1, 2, 3, 4, 5, 6, 7)
Lower on three (4, 9, 10)

TABLE 7
THERMODYNAMICS EXAM COMPARISONS

EXAM I			EXAM II		
Fast Track	4-Year Student		Fast Track	4-Year Student	
100	100	55	100	95	75
80	70	50	85	60	75
90	55	70	95	95	80
100	98	100	80	95	95
100	55	90	95	75	65
95	100	90	100	95	55
100	45	65	100	45	92
70	100	25	93	65	85
100	75	100	97	90	98
60	60	35	92	30	55
	70	80		73	60
	30			55	
Range=60-100	Range=25-100		Range=85-100	Range=30-98	
$\bar{X}$ =89.50	$\bar{X}$ =70.34		$\bar{X}$ =93.70	$\bar{X}$ =74.26	
sd =14.62	sd =24.20		sd = 6.67	sd =18.99	
U = 60			U = 30		
z = 2.15			z = 3.00		
p < .05			p < .05		

How The Curriculum Has Evolved

It is very important to emphasize that the curriculum, now a package of 36 credit hours, has continued to develop and evolve during the two offerings of the program. Some of the changes that improved the curriculum include: (a) adding more laboratory courses to give students more "hands-on" experience; (b) adding six hours of engineering courses in each track that could be applied toward a second degree; (c) integrating Fast Track students with undergraduate students in equivalent courses in the regular curriculum; (d) removing the six hour mathematics review sequence for the electrical track (most of these students were mathematics majors); (e) expanding the number of courses taught by the self-paced approach. All of these changes were made as a result of the students, faculty, and project staff evaluation of the program and the oustanding academic capability of the participants. Appendix D contains reports on curriculum development from faculty in the chemical, electrical, and mathematics segments for Fast Track I and II.

SECTION 8

IMPORTANT NON ACADEMIC PROGRAM FEATURES

Introduction

Professional development is an educational process that develops a person's identity as a professional in a particular field of study, involves career planning for career growth, and analyzes and educates for particular work styles and work attitudes needed for professionalism. We felt it was particularly important to include a formal approach to professional development for our reentry audience because many participants were transitioning from science related careers to engineering and others would be entering engineering from an under or unemployed career status. In addition, for women the transition into engineering is a transition into a nontraditional career field. In the one year Fast Track program we did not have the normal four year educational period which includes experiences such as co-op or summer employment to aid in building an identity as a professional engineer.

We began our professional development effort with a motivational and diagnostic week. This program feature helped women to identify their career goals, their identity as professional engineers, and to formalize a commitment to the program. We continued this effort by holding seminars on job hunting skills, interviewing techniques, and techniques for continued career growth during employment.

To provide an overview of the professional development course it would be beneficial to review its evolution from early conceptualization in Fast Track I.

The Motivational and Diagnostic Week - The Beginning of The Professional Development Effort

Although the first two days of the first Fast Track Program coincided with a major snowstorm and record cold weather which closed the university and much of the state, the Motivational Week began on schedule on January 18, 1977. The fact that in spite of the shutdown all faculty, industry representatives, and women professionals were present for the Motivational Week was itself a motivating factor for the Fast Track students. The Motivational Week consisted of four days of planned activities which included panel discussions on late entry into engineering, the nature of chemical and electrical engineering, career and life planning seminars, and academic counseling. (Consult Appendix C for outlines of the Motivational Week).

The Late Entry Panel of Women Engineers represented women who have returned to training in engineering following a career interruption due to either family commitments or through career change. For Fast Track II we also included women who had completed our first Fast Track Program. These role models spoke of the rewards of their engineering careers, the interest of industry and government in women engineers, the difficulties they experienced in returning to school, and their expeiences in the Fast Track program. The Late Entry Panel members also stated that they had difficulty adjusting to lower grades as late entry students. Many had been straight A undergraduate students and had received a low F on their first test when returning to school. The Late Entry panelists were positive in discussing the varied aspects of returning to school in an engineering profession, but they were also honest about many of the difficulties. The Fast Track students appreciated and were able to relate to the comments of these women who "had been there."

Another component of the Motivational Week consisted of a faculty panel. Four members of the University of Dayton faculty in the Fast Track program presented information on the variety of applications and employment opportunities for electrical and chemical engineers. The students, faculty, and Late Entry Panel then continued to discuss topics of interest during an informal lunch sponsored by the University of Dayton.

An Industry Round Table was also a feature of the Motivational Week during Fast Track I. During the Industry Round Table, representatives from industries presented career opportunities and the role of engineers in their industries to groups of four to five Fast Track students during four 20-minute rotation periods. Since a number of the students had indicated an interest in part-time employment, industries represented at the Round Table had been approached about possible part-time employment for these students. As a result, an industry that wanted to hire six students in the electrical track was openly interviewing, and several other industries were open about being interested in employing some of the students. Although this was a very powerful phenomena in convincing students that career opportunities would be available at the completion of the program, the fact that industries were interviewing and forming opinions that could affect ultimate placement was considered a negative feature. We therefore moved the industry panel to a date later in the program during Fast Track II.

The second day of the Motivational and Diagnostic Week began with a math placement test to evaluate the level of mathematics knowledge and to allow for advanced placement in the mathematics sequence of courses. As a result of this effort, two students in the electrical track placed out of the first mathematics course which was a review of calculus. Our experience with

the superior background of electrical students in mathematics led us to replace the six hours of mathematics with electrical engineering courses and there was therefore no need for a mathematics placement examination.

Building Nontechnical Skills: The Motivational and Diagnostic Week-Part II

Although the motivational and diagnostic features which were to address the psychological factors were considered important during the program design state, observation and formative evaluation of the participants' reaction to the Motivational Week redefined and increased the importance of the role of these program features. As a result of the Motivational Week and the work of Dr. Adele Scheele and Dr. Beverly Kaye (Drs. Scheele and Kay in Fast Track I, Dr. Scheele in Fast Track II), the goal of developing program components to deal with the psychological factors was expanded, redefined, and clarified to include designing program components to build "nontechnical skills."

Nontechnical skills identified as most important to the Fast Track Program were skills that would lead to positive self-concepts. For example, it will be important for the Fast Track students to emerge from the program with an identity as an engineering professional. In order for their identity as engineering professionals to grow, they must become familiar with such basics as work habits; manner of dress; their past, present and emerging self-image; and the language of the engineering profession.

Although the total importance of building nontechnical skills only emerged with time in the mind of the project director, it was apparent even before the Motivational and Diagnostic Week began, that it would be critical to provide the Fast Track students with a more positive self-concept; the ability to accurately evaluate their potential for achievement; and experience in setting realistic goals. In the opinion of the project director, the

women in the Fast Track program will have to develop these skills before they can emerge from the program as engineering "professionals."

The most intensive part of the Motivational Week devoted to building nontechnical skills was conducted by Drs. Scheele and Kaye and consisted of Career Seminars that dealt with the nontechnical skills of building positive self-concepts; establishing career related parameters for improved self-management; and organizing support groups to provide a nucleus for encouragement and situation-specific problem solving throughout the year.

Drs. Scheele and Kaye introduced their workshop by defining "careering" as a progression through life which emphasized being active rather than "reactive." The consultants briefly outlined the three critical careering skills of self-presentation, positioning, and connecting; and divided the workshop into three sections in order to deal with each of these skills. Throughout the workshop, the consultants themselves modeled positive self-concepts and projected a high level of competence, self-confidence, attractiveness, and mutual support. The self-presentation skills required the Fast Track students to assess themselves, school, and career skills; and/or provided them with the opportunity to reshape their self-image, and to build self-confidence.

In order to work with the large groups of 31-39 women, the consultants divided the major group into smaller groups of four to five women. These groups were called Focus Groups in Fast Track I and Support Groups in Fast Track II and were formed according to common interests of academic and marital similarities. These groups remained together throughout the workshop as a working group, and it was planned that they would function as support groups for the remainder of the program. Building the support groups worked better in Fast Track II, when the groups were formed around their ability to contribute differently in an academic sense to the group.

The consultants worked with the Support Groups in order to formulate the self-presentation skills through a series of simulation exercises. In the first exercise, the women were asked to mold and bend a telephone wire to simulate the ups and downs of their life (a life line) and to present their life line to the other members of the group. Most of the Fast Track students indicated that they were at a low or indecisive point immediately before acceptance into the program and they viewed acceptance into the program as a new high. The project director and consultants discussed the implications and pressure that this may place upon the program. After the life line exercise, the consultants presented research that indicated differences in the way men and women perceive and talk about their successes and failures. Women attribute their successes to others, to luck, or to anything but themselves, and accept all the responsibility for perceived failures. Men, on the otherhand, accept responsibility for their successes and describe failures with the nonjudgmental phrase: "It didn't work out." As a final component in formulating self-presentation relating something interesting about herself in a thirty second period. The consultants coached the students in self-projection during this exercise.

For the last exercise of the first session, the students were paired so they could discuss their success experiences for a period of ten minutes. The students were to begin their success stories from the time they were in kindergarten. The students found this exercise surprising because they could not cover all their successes in the allotted time period. The consultants then pointed to the fact that women routinely concentrate on the negative aspects of their lives, rather than the positive; while men routinely concentrate on the positive aspects of their lives, rather than the negative.

During the third day of the Motivational Week, the consultants began to build the Positioning Skills. These skills included developing behaviors to establish roles for being viewed as a valuable member of an organization, offering something unique beyond simply doing an assigned job, building a network of colleagues, supporters and proteges, and setting realistic goals. Positioning skills were discussed via a summarization of the research done by Dr. Adele Scheele on the behaviors exhibited by successful people and the number of "risks" taken by successful people.

Dr. Scheele's research indicated six consistent behaviors over a broad range of successful careers:

1. To Experience Doing - Successful people begin many activities, learn from them, move on with the experience to different activities. They initiate activities, rather than being solely reactive. They risk not doing something well for the new experience. Few activities are continued, and those continued are on a selective basis.
2. To Risk Linking - Successful people take the risk of linking up people, groups, organizations and ideas. Emphasis is on letting go of behaviors no longer useful and connecting with those ideas, and people which lead to new ways of thinking and doing.
3. To Show Belonging - Successful people show they belong to the group, enhance the importance and achievements of the group, don't threaten it, and protect it from attack. They recognize that they are personally enhanced

by the group's accomplishments and recognition, and that they enhance the group by their own membership.

4. To Exhibit Specializing - Successful people let the group know what they can do for the group above and beyond the actual job required.

5. To Magnify Accomplishments - Successful people achieve recognition for themselves and their group by magnifying accomplishments.

6. To Use Catapulting - Successful people recognize the importance of others in helping them go beyond their own resources, are willing to make use of resources from others, and express appreciation for the use.

The consultants related these six critical career skills to the difficulties women specifically have with the skills, and they gave numerous examples of the use of these skills. The consultants then presented the Connecting Skills which included strategies for determining action plans to meet goals, for extending the University Fast Track experience to future careers, and for building resource networks. A number of exercises were used to allow participants to begin working on developing the six critical career skills and to connect the University Fast Track experience to career goals.

The wrap-up of the program included asking participants to remain in their Groups and to meet weekly for specific activities designed to support each other and assist in problem solving. The final exercise of the Motivational Week included a session in which each participant and the project leader told the group about the most important facts that they had

received from the seminar. The Fast Track students were then asked to evaluate the Motivational Week. (Consult Sections 10 and 11 for Herman Torge's* evaluation of that week).

Building Nontechnical Skills: A Continuing Effort

The Project Director has made an even greater commitment than was envisioned at the time Fast Track was conceptualized to the goal of building nontechnical skills as a vital component of the Fast Track Program. In order to facilitate the continued building of nontechnical skills, Nancy Cook Cherry, an expert in the area of life planning and careering for women, was added to the staff to help develop future programs and workshops designed to deal with the problems facing the Fast Track students, to help them emerge as professionals, ready to compete in the predominantly male engineering profession.

As a result of the evaluation of the positive effect of the professional development effort, we formalized this approach and integrated it into the curriculum as a Professional Development Course. The Professional Development Course was developed to include skills assessment modules, job hunting skills modules, and planning for career growth modules; these modules were presented in a lecture/workshop technique. However, a great deal of learning in the Professional Development Course occurred through individualized instruction as the participants confronted actual situations in the job hunting process.

The Professional Development component not only addressed the need for technical skill development (i.e., we are transitioning participants from science backgrounds to engineers), but an almost equal amount of time is spent developing nontechnical or soft skills. The Professional Development Course uses a lecture and workshop format. The professional development

*Herman Torge is the Evaluator for the Project.

component of the reentry program has as its objectives, building the professional identity of women in a nontraditional field, such as engineering, and addresses itself to building skills that women have been categorized as lacking, i.e., getting in on the informal informational network, learning how to be part of a team and communicating with others are examples of subjects the course addresses.

Much attention has been given to the subject that women, much more than men, tend to act as individual contributors rather than team members. In engineering, it is well recognized that most problems are solved in the team or community environment. Therefore, through workshops and with the help of role models, action is initiated to practice solving problems in a team or community spirit. Further research indicates that engineers must have access to informal sources of technical information to satisfy the conditions for professional advancement . If women have limited access to this informal communication network, their development as professionals will be hampered. For example, if women are excluded from conferences, in-house seminars, lunch groups, and other informal meetings, they will be excluded from this important avenue of information. Therefore, the professional course attempts to point out the importance of informal information and develops strategies for women to merge into the system and gain this information.

The Professional Development Course also attempts to explore the world of engineering from the viewpoint of women and answer questions such as, will women have identity problems in the male oriented engineering world? Will their work habits, manner of dress, and language be different or the same as male engineering professionals? The course also addresses, or has

as its goals, identifying the kind of job she wants, and building a careering methodology so that the women can identify long and short range career goals and develop appropriate strategies for attaining them.

Participants in the Professional Development Course are asked to develop self-assessment skills and gather information about career options in a specific area as well as learning techniques for long-range career planning which goes beyond gaining entry into a chosen career field.

We feel that the Professional Development Course attempts to maximize the women's self-concept as professional engineers with strong personal career directions based on their individual strengths, interests, and technical abilities.

In the Fast Track Professional Development Course much more time was spent on assessing strengths from prior experience and relating those experiences to engineering careers than would be the case for traditional undergraduates.

Professional Development - Working With the Students Instructor's View Point

In terms of "professional" growth, identity, and self-presentation skills, the groups have varied enormously. The person who is newly out of college has a very different life space than the person who has been out of college twenty years and has college age children.

Since this was a group of women planning for professional careers, much emphasis was given to specifically focused problems on family and career, the history of women in engineering, and issues for women in science and engineering. These topics would receive a much smaller focus in a coeducational class.

In Fast Track II, the professional development class was the only class that both electrical and chemical Fast Trackers took together. They appreciated the opportunity to get to know women from both groups, but were bored if the information was focused more for one group than the other, e.g. when the guest speaker was a chemical engineer or when a report was given on career opportunities in electrical engineering.

Combining the two groups produced a class size of 31 women in Fast Track I and 37 women in Fast Track II. The course at best should be no larger than 20-25 participants to maximize discussion opportunities. The course was originally designed in a workshop type format relying heavily upon participants sharing from their own experiences and drawing conclusions from the larger group experience. This format was not well received by many because it was seen as taking too much time to cover the material when time was seen as a highly critical factor in their lives.

The course was shifted to a much structured, lecture format which was better received. However, much of the professional movement in individual attitudes and planning is then shortchanged. Therefore, the workshop style has been incorporated into the course along with interspersed lecture materials. The course is outlined in the following representative syllabi and copies of the final exam.

PROFESSIONAL DEVELOPMENT COURSE

Fast Track II

The goal of the career education and professional development component of the Fast Track II program will be to maximize the students' self-concepts as professional engineers with strong personal career directions based on their individual strengths, interests, and technical abilities. We feel that incorporation of a Professional Development course into the Fast Track II curriculum will produce more employable graduates who can quickly be productive in their first engineering jobs. Input from industry engineers, engineering faculty and industrial employers will aid significantly in development and delivery of the course content. A synopsis of the Professional Development course is as follows:

COURSE SYNOPSIS - PROFESSIONAL DEVELOPMENT COURSE

Text: Richard Irish. If Things Don't Improve Soon, I May Ask you to Fire Me. Bettly L. Harragan. Games Mother Never Taught You.

I. Preparation Topics

Orientation
Study Skills
Dealing with Academic Re-entry, Test Anxiety, and Related Topics

II. Career Planning Topics

A. Overview on Career Planning-Personal Assessment

1. Assessment of personal strengths, skills, and interests. Success experiences - participant exercise. Strength bombardment - participant exercise.

2. Assessment of personal obstacles to the job market and planning ways to overcome them; e.g., specific skills needed to match engineering job interest.

B. Assessment of the Job Market

1. Using engineers as career information resources (What do engineers do?)

2. Obtaining information about prospective engineering employers from career placement officer, engineering literature, engineering role models (where are engineers employed?)

C. Development of Personal Job Hunting Skills

1. Written Materials, i.e., resumes, college interview forms, company application forms, cover letters, letters of job acceptance and refusal, personal "personnel" file and press releases.

2. Oral Presentations - Interviewing for Success
Being an active participant in the job interview, determining the nontechnical skills companies look for on the campus interview, preparing for engineering plant visit interviews, and exchanging interview experiences.

3. Participating in a Mock Interview - (Potential engineering employer will interview each student and critique the video-taping of each interview).

III. Professional Development Topics

A. Problem solving methods of scientists, engineers, and managers (Emphasis will be placed on transitioning from mathematician/ scientist to engineer).

B. EIT (Engineer in Training exam) Importance of Certification/ Registration and PE exam (Professional Engineer's exam) - What do they cover, who can take them, and why and when should they be taken? Engineering guest lecturer.

C. Continuing Education - the problem of obsolence for engineers (should engineers be recertified?)

D. Individual topical presentations: for practice of presentation skills on an area of interest.

IV. Career Planning for Future Professional Development

A. Understanding behavior characteristics of successful professionals.

B. Evaluating the importance of management training programs. Developing five-year plans. Are engineers different?

C. Utilizing Professional Organizations

D. Evaluating Upward Mobility (Deciding when to stay and when to go).

E. Obtaining and Responding to Performance Evaluations.

F. Being a Role Model (what do you owe to those who paved the way, and the ones who come after?).

PROFESSIONAL DEVELOPMENT

EGI 399

Project Teams and Skills and Obstacles Teams

Project Teams are designed to develop teamwork, to provide an opportunity for use of team presentation skills, and to allow each participant to exhibit her special contributions to the entire group.

Each member of a Project Team will receive the same grade. Project grades will be based in part on group evaluations of the presentations. A project grade will account for 20% of the total grade in the Professional Development Course.

Skills and Obstacles Teams (S&O Teams) are designed to develop personal assessment skills for furthering career planning and problem solving techniques for overcoming obstacles to the job market and future career opportunities. The task of the S&O Teams will be to assist each team member in defining success experiences and the skills implicite in the success; and further to assist each member in determining realistic alternative solutions or options available for dealing with career obstacles. S&O Teams will meet twice a term with the instructor to determine team progress and make task modifications.

Grading and Exam Procedures

There will be three exams for the course; one at the end of each term. Each exam will count for 20% of the total grade.

Each student will be encouraged to keep a notebook for the course. Contents of the notebook should include copies of reading handouts, lecture notes, personal resumes, cover letters, college interview forms, leads for job contacts, etc.

Exams will be open notebook and will cover applications of the course content of the term being examined.

Presentations and projects developed by Project Teams will account for 20% of the grade. See handout on Project Teams for fuller description of projects available.

The final 20% of the grade will be based on class attendance and participation. The quality of the total course will depend largely upon the active participation of each person. Through project presentations, class discussion, and regular feedback, the course will largely reflect the interests and ideas of the participants. While there is much content to be covered in the course, there will be ample opportunity to cover issues of concern to each participant.

TEAM PROJECT TOPICS

Each team will choose one topic for research, development, implementation and class presentations. Check Course Schedule for date of Team presentation. Each team will select a captain for coordination with the instructor.

No. in Team	Topic
4	Social Opportunities - Team will research social opportunities - art, music, drama, festivals, sports, outdoor recreation, etc. - and report on them to class. Periodic update on coming events will be appropriate. Team will plan and implement two social events for Fast Track II participants.
3	Tournament and Graduation - Team will plan and implement a tournament for Fast Track participants involving non-engineering activities. Team will plan graduation program in conjunction with Project Director.
3	Professional Organizations - Team will explore engineering organizations, both student and professional, for both chemical and electrical engineering to report on organizational goals, activities, membership categories and requirements, membership services, meetings, journals and dues. Team will explore professional women's organizations, both adult and student, and report on their goals, activities, services, membership categories and requirements, meetings, journals, dues.
4	Employment Opportunities for Chemical Engineers in Industry - Team will research the general areas of chemical engineering (e.g. Research and Development, Production, Manufacturing, Quality Control, Sales, etc.) and report on* the characteristics of the jobs and how they differ; what personal qualities are important to the job; career ladders possible, particular engineering skills and complementary skills appropriate.* * All reports on Employment Opportunities should cover questions between the asterisks.
4	Employment Opportunities for Chemical Engineers Outside of Industry - Using topics given above for report, the team will research employment options with government, utilities, academia, medical employers and report on them.
4	Employment Opportunities for Electrical Engineers with Computer Skills - Using report topics listed above, team will research computer based employment opportunities for electrical engineers and report on them.

No. in Team	Topic
4	Employment Opportunities for Electrical Engineers in Manufacturing and Industry - Using report topics listed above, team will research the general areas of electrical engineering (e.g. Research and Development, Production, Manufacturing, Quality Control, Sales, Maintenance, etc.) in industry and report on them.
4	Employment Opportunities for Electrical Engineers with Utilities, Medical, Insurance and Academic Employers - Team will research these areas and report on them covering topics listed above.
4	History and Research on Women in Engineering - Team will research history of women in engineering including numbers of women entering engineering careers and contributions of women. Team will explore research findings on similarities and differences in men and women engineers and engineering students.
4	Women and Engineering Issues for Fast Trackers Team will conduct a survey study of the most difficult questions women in Fast Track Program are asked and evolve alternative means of answering them. Team will research issues involved in areas of home, family, and sexuality, the career implications and options available.
4	Engineers and Management - Team will research and report to the class on the following questions: What is management? How does project management and people management differ? How does it differ from supervision? Do engineers manage? What are the reasons for and against moving into management; how can it be done; when is it done?

EXAM
EGR 399
PROFESSIONAL DEVELOPMENT

This exam is an open book, take home exam. You may consult with anyone necessary to answer question 5.

1. What are 3 qualities that others see in you that would be helpful to you - or your employer - on a job?

2. Give an example of where you have set a goal to achieve and achieved it.

3. Give an example of where you have had to convince other people to do something you wanted. How did you do it? What was accomplished?

4. What would your best friend say you need to work on the most?

5. Give three brief job descriptions of jobs you would be interested in exploring. For each tell what you would do on the job, what kind of organization might have such job openings, what you would like about that kind of job and organization, and why you would be a better candidate for the job(s) than anyone else.

Due Date: Received in my office no later than August 8, 1979.

Name _____

FINAL EXAM
EGR 399

1. Please draft sample letters on the following topics. Use one page per letter, set it up exactly as you would type it to mail. Legible handwritten letters are acceptable.

   A. Job Refusal
   B. Job Acceptance
   C. Cover letter to inquire about an engineering job you would be interested in

2. Assuming that you get the initial engineering job you want, and everything goes well on the job, what is the second job you want and why?

3. Which of the textbooks did you get the most out of? What were the most important points you got from each of the texts?

4. Please complete the attached evaluation of the Team Projects.

5. Depending on your placement status answer the appropriate question. If you would like any consultation on the following questions, I would be available to do so.

   A. Have Accepted Job -
   What do you perceive to be the most important skills, qualities, and/or personal characteristics that will be necessary for successfully fulfilling the job you have accepted?

   B. Am Making Decision Between Several Attractive Offers -
   What aspects of the job are you evaluating? How does each job compare to the other(s) on these aspects?

   C. Have not yet Found Job that I am Planning to Accept -
   Please outline the steps you are planning to take to obtain job that you are interested in. Note any obstacles you perceive and methods that you will use to overcome the obstacles.

This exam is due in on Wednesday, December 12 at noon. If you want to take it in class, the exam will be in KL-203 from 10:00-12:00.

The exam is worth 200 points, and points will be deducted if the exam is turned in late.

UNIVERSITY OF DAYTON
DAYTON, OHIO 45469

SCHOOL OF ENGINEERING
OFFICE OF THE DEAN
Telephone: 513/229-2736

October 26, 1979

TO: Fast Track Professional Development Class

FROM: Mrs. Nancy Cook Cherry

SUBJECT: Evaluation of Team Projects

It is time to consider grades for the Team Projects. The overriding purpose was to provide the entire class with important and meaningful information or activities on relevant topics and subjects. In order to evaluate these projects I would like for each of you to remember the projects and give your feedback on them. Please use the rating scale provided and rate each on all items. On your own project please use the separate scale provided.

Please give each presentation (that you attended) a score on both variables (1) quality of content and (2) quality of presentation.

Quality of Content

1= information irrelevant, not useful, unimportant
2=
3= 1/2 of information was relevant, useful, important
4=
5= all of the information was relevant, useful, important

Quality of Presentation

1= Poor
2= OK
3= Average
4= Good
5= Excellent

Your Name _____ Chemical _____

Electrical _____

____ ____ Social Opportunities;

____ ____ Tournament and Graduation;

____ ____ Professional Organizations;

____ ____ Employment Opportunities CME in Industry;

____ ____ Employment Opportunities CME outside Industry;

____ ____ Employment Opportunities EE with Computer Skills;

____ ____ Employment Opportunities - EE in Manufacturing and Industry;

____ ____ Employment Opportunities - EE in Utilities, Medicine, Insurance, Academia;

____ ____ Employment Opportunities in Alternate Technology;

____ ____ History and Research of Women in Engineering

____ ____ Women and Engineering Issues;

I would appreciate your comments on your team project.

Project Team I served on; _____

1. Please comment on the degree to which the project was a team effort where everyone did their share _____

_____

_____

2. Please comment on how meaningful, informative, etc. working on your project was to you _____

_____

3. Did you learn anything about your work habits or how you prefer to work on team projects? _____

_____

If yes, please explain _____

_____

4. Would you recommend team projects be used in this course in the future?

Please make any comments you would like on ways these could be improved

_____

_____

SECTION 9

PLACEMENT

Introduction

We utilized three different strategies to place participants completing the Fast Track program: (1) A Job Fair offered to major employers of engineering graduates; (2) Regular University placement procedures; and (3) Self-placement. Self-Placement was especially needed when we faced particular problems of placing participants who had geographic restrictions or preference for a particular job type.

The Job Fair

The Job Fair was a concentrated placement effort and our most successful placement strategy. We invited approximately 150 industries for Fast Track I to participate in our Job Fair and received about 60 acceptances from national and local industries. Participating industries arrived the evening before the Job Fair in order to hear a presentation about the design of the program, its academic content, and to informally discuss the program with faculty and project staff. During the program held the evening before the Job fair, employers presented information about their organizations to Fast Track participants.

Findings

Several days after the Job Fair for Fast Track I a survey was taken requesting data from the Fast Track participants concerning this part of the project. The questions and responses follow:

1. Were you able to gather the information you wanted about the companies you wanted? If "no", why not?

	Chemical	Electrical	Total
Yes	5	12	17
No	1	4	5

Those answering "no" indicated the representatives were not aware of plants in other locations only their own local operation.

2. Did you interview? If "no", why not?

	Chemical	Electrical	Total
Yes	6	16	22
No	1	1	2

Of those who did not interview, one had a job and the other wanted a company not represented. The number of interviews taken varied from none to as high as ten. Most persons interviewed with four or five industries.

During the second Fast Track Program we organized two Job Fairs in order to give more attention to local employers and to students who wanted to be placed locally. This report section contains a chronological account of the activities performed to accomplish two Job Fairs for Fast Track II, a critique of the elements involved, recommendations for the future, and copies of materials developed.

Job Fair Fast Track II

Original invitations to participate in the 1979 Job Fairs were sent to 385 companies. Company representatives were selected from mailing lists from Fast Track I Job Fair, the University of Dayton Placement Office, local and state contacts from the Engineering Coop Office, and from the suggestions made by women in the Fast Track program. Companies could respond that they were interested in participating, wanted more information, or would interview later. All companies responding were sent additional information on the

curriculum. Company recruitment literature was requested from companies planning to participate.

During a one-day workshop, Fast Trackers reviewed company literature, got a briefing on how to work with the Placement Office, and signed up for interviews with companies planning to participate. Approximately 60 companies indicated that they wished to participate in the Job Fair.

We analyzed the companies coming and the locations sought by Fast Trackers and sent additional invitations to chemical engineering-type companies in the northeast United States to generate more of these companies. We also personally contacted companies we hadn't heard from where we had strong contact people. This was very important. Some of our major industries had not responded to the initial contact, but did immediately upon personal contact.

In order to determine campus interest in companies, senior engineers were invited to sign up for interviews with companies that had indicated an interest in seeing seniors as well or for companies that had small Fast Track signups. Senior signups varied from 1-2 for some companies to 12-14 for others.

Companies were then sent sheets including the names of Fast Trackers signed up for their companies and resume books. Companies with small registrations were contacted by phone or by mail and asked if they wanted to participate with the number of Fast Trackers and seniors registered. Companies already planning campus visits generally did not attend. Many others did, including one company which had no Fast Trackers scheduled. They ended up interviewing several Fast Trackers.

As companies dropped out of the program some rescheduling was necessary. Because our procedures were not exactly the same as those used by the Placement Office, some confusion occurred in the coordination of senior registration. This, coupled with questions by seniors on the equality of letting Fast Trackers sign up for interviews prior to seniors, suggests that the mechanism for including seniors in a Fast Track Job Fair will need to be seriously reconsidered for any future program.

Companies made last minute decisions about participating and who and how many people would represent the company. This even occurred without their contacting us ahead of time. Companies were asked for a $75.00 contribution/ registration fee for up to two people attending and $25.00 for each additional person.

The Job Fair was divided into two separate events - one for local companies scheduled September 12-13 and one for national (or non-local) companies scheduled one week later.

There were 18 companies at the Local Job Fair, seven of which do not schedule interviews at the University of Dayton (38.9 percent). There were 25 companies at the National Job Fair, ten of which do not schedule interviews at U.D. (40 percent). A number of these companies now regularly schedule recruitment visits to the University of Dayton.

Each of the two Job Fairs consisted of essentially the same format. Registration was at 5:00 with a brief social preceding dinner. The local program was all held in the West End of the Ballroom of the Kennedy Union Student Center. The national registration and social was in the Art Gallery with dinner in the Faculty Dining Room of the Kennedy Union. The separate accommodations were excellent but created a few logistics/materials problems. Following dinner presentations were made by the Project Director, the Dean of

Engineering, and by both Department Chairmen on the history of the program, the quality of the instruction, and the quality of the candidates.

An important addition another time would be to have a presentation on logistics by the Project Manager for the Job Fair. Written information was given but not read by the company representatives.

Following dinner each industry had a table for presentations about their company. An informal timing system was used to allow students to move from company to company. Fast Trackers and seniors participated; they were asked to spread themselves out in small groups and visit as many companies as possible.

For the Local Job Fair additional interviews were scheduled by Nora Prendergast, Project Assistant for the Job Fair. For the National Job Fair, additional interviews were scheduled directly with the companies. Company schedules were then collected at the end of the evening and xeroxed the next morning and returned to the companies by 8:30 a.m.

Companies raved about the quality of the candidates, the seniors, the Wednesday evening format and the entire organization of the program. Several interviewers commented that it was the best slate of candidates they had ever seen on a campus interview schedule.

Approximately 500 interviews were held for 36 Fast Trackers and 51 seniors. Four days after the National Job Fair 31 Fast Trackers (all but 5 chemical) had invitations for plant visits.

See attached critique for evaluation of individual components.

RECOMMENDATIONS:

Charge a higher registration fee if economy warrants. Have very different program for local Job Fair in order to charge a smaller fee for local participation if the numbers of Fast Trackers wishing local placement warrants.

Include seniors only in Wednesday evening program. Check with EEO Director for legality of letting them sign up with companies directly at the Wednesday evening session.

Consider having major national companies come for two days in a row to spread the appointments better to smaller companies.

Encourage Fast Trackers to over sign up for the practice, particularly chemical students.

Ask companies for descriptions of the jobs they will be interviewing for. This would help Fast Trackers make more informed choices.

SPECIFIC COMPANY FEEDBACK:

"Really enjoyed the Job Fair, Wednesday was excellent."

"Women were business like, well prepared, professional, and set for their interviews."

"...incredibly impressed with the women. They did their homework before coming and that's good....couldn't believe how well they handled their interviews....but you really need to help them with their self-confidence. They are incredibly capable but don't believe they will be able to handle the jobs available."

"...absolutely super. I'm inviting 8 out of 9 interviewed, and I never invite over 25% from campus interviews.

From a former Fast Tracker..."...they really didn't know anything about technical sales...If I had been invited to talk to them, they would have known what sales is all about."

"...really head and shoulders above what you usually see on campus."

From GE publicity man..."...super cooperation from Dick Ferguson, Carol, Nancy...all very helpful...campus is dynamic, really gorgeous, comfortable place to be. U.D. is 27 levels about what I expected it to be."

FAST-TRACK LATE ENTRY
WOMEN IN ENGINEERING
EVALUATOR'S REPORT
JOB FAIR - INTERVIEWS

On Tuesday September 13, 1977 there was held a Job Fair for the women in the Fast Track Program as well as for interested students from the School of Engineering. This was followed the next day with interviews by the companies, again of the women in the Fast Track Program and selected engineering students.

A total of 25 industries took part in the Job Fair. These were assigned four or five to a room. During the time allowed, each industry made a five minute presentation with question period at the end. Presentations were of a very general nature giving an overview of the company, its products and the kind of engineering persons they were seeking. Participants were assigned to three different rooms with the final (fourth) rotation being free choice. All told a participant had a brief exposure to some 15 to 20 companies.

That evening, company representatives (interviewers) were guests at a dinner at which time a presentation was made on the Fast Track Program. Participating in this presentation were Carl Shaw, project director, Ronald Servais, chairman of chemical engineering, and Bernhard Schmidt, electrical engineering.

The following day scheduled interviews were conducted by the companies. Interviews were granted on a choice basis

through sign-up by students.

A questionnaire was administered to the Fast-Track women several days after the interviews. The results are tabulated below.

TABLE I

	Electrical N=17	Chemical N=7
1. Did you interview?	Yes - 16 No - 1	Yes - 6 No - 1
2. Were you able to gather enough information about the companies you wanted?	Yes - 12 No - 4	Yes - 5 No - 1
3. How many interviews?	3 - 1 4 - 3 5 - 4 6 - 5 7 - 2 8 - 1	3 - 2 4 - 2 6 - 1 10 - 1
4. Were you satisfied with your interviews?	Yes - 12 No - 5	Yes - 3 No - 4
5. Do you feel positive about your job prospects?	Yes - 14 No - 3	Yes - 4 No - 3

Respondents were also asked to give comments if they responded negative to some of the questions. The comments are listed by track, and the question to which they relate.

Chemical Comments

1. Did you interview?

   a. I did not participate because of the geographical restriction I placed on myself.

2. Were you able to gather enough information about the companies?

   a. The job fair was a great idea.

4. Were you satisfied with your interviews?

   a. Only with one - I felt I sounded as though I did not know what I wanted.

   b. I wasn't prepared to be considered above entry level.

   c. I had problems bringing out my good points when the interviewer did not ask.

5. Do you feel positive about future job prospects?

   a. I feel I will get a job, but not necessarily in the area I want.

Electrical Comments

2. Were you able to gather enough information about the companies?

   a. Most information; many interviewers did not know about opportunities in certain areas.

   b. Representatives seemed branch, rather than company minded.

4. Were you satisfied with your interviews?

   a. Several companies had not informed us ahead of time about the positions they were or were not interviewing for.

   b. No choice of interviews if there was more than one.

   c. I had decided I didn't like some of the companies signed up for, but I couldn't get out. Made for uncomfortable position.

d. Very pleased!

e. Pleasingly surprised!

f. Felt some of the companies know nothing of the program. Felt they wasted my time and theirs.*

*(Evaluator's comment: Having attended the dinner of the previous evening and heard the presentations about the program to the industry representatives, I feel that the above comment is, if valid, the fault of industry. Either they weren't listening or they did not attend.)

The data from Table I and the few negative comments would indicate that the Job Fair was successful.

-Herman Torge

Placement Results

Placement results for both Fast Track programs have been very good. Ninety-six percent of participants in Fast Track I were placed in engineering positions, many with Fortune 500 companies. The salary offers received by the 1977 Fast Track graduates more closely paralleled offers being made to master's degree recipients and were higher than offers made to four-year graduates. Fast Track graduates of the 1977 program received 79 job offers from 25 different industrial firms. Only two persons in the 1977 program received no job offers. One because she went back to her former employer and the other because she had a student visa which did not permit employment. As illustrated in Table 8, the average salary offer to chemical engineering Fast Track I graduates was $18,130 and the average gain or salary increase for those working was $4,238. The average salary offer to electrical engineering graduates was $16,490 and the average salary gain for those who were employed at the time they entered the program was $6,448.

The same placement results occurred for Fast Track II, with one interesting exception. The modification of the academic program from 30 to 36-39 credit hours has had an effect on the timing of the placement effort. Since we intensified the academic portion of the program and provided the option of working towards an engineering degree, many more participants decided to invest more time and effort into taking extra degree requirements while they were at the University. Therefore, more participants delayed the time and effort required for placement activities until after the 12-month academic part of the program.

One and one-half months after completing the 12-month Fast Track program, 74 percent of the graduates had been placed and 41.6 percent of

the remaining participants had job offers. One year after graduation, all but two of Fast Track II students have been placed. The range of salary offers for Fast Track II graduates is $14,600 to $26,000. Four participants have accepted salary offers under $20,000, eight have accepted salaries between $21,000 and $21,990, and 15 have accepted salary offers over $20,000.

TABLE 8

JOB OFFERS RECEIVED - FAST TRACK I

	No. of Offers									
	0	1	2	3	4	5	6	7	8	9
Received By	1	3	12	4	0	5	0	1	0	1

Table 9 displays data on salaries for the various persons in Fast Track I by track. The data are incomplete in some instances. If all of the pre-entry salary information for the electrical were available it is unlikely that the average gain would be lower.

TABLE 9

FAST TRACK SALARY COMPARISONS - FAST TRACK I

Chemical Track	Pre-program salary	Engineer Entry salary	Gain
	16,000	18,600	+2,600
	16,000	19,300	+3,300
	13,000	17,040	+4,040
	14,800	18,300	+3,500
	9,500	18,000	+8,500
	11,500	16,000	+4,500
	17,300	19,800	+2,500
	14,040	18,000	+3,960
		$\bar{x}$ =18,130	$\bar{x}$ =+4,238
Electrical Track	-	15,900	-
	16,800	17,300	+ 500
	15,333	18,274	+2,941
	12,000	12,000	-
	-	14,400	-
	-	15,000	-
	7,000	17,500	+10,500
	4,000	17,000	+13,000
	9,000	16,000	+7,000
	12,700	16,000	+3,200
	12,000	20,000	+8,000
	-	16,800	-
	-	18,200	-
		$\bar{x}$ =16,490	$\bar{x}$ = +6,448

SECTION 10

SPECIFIC EVALUATION REPORTS
FAST TRACK I AND II

Introduction

During all phases of Fast Track we utilized outside evaluators to help us monitor the program and for formative and summative evaluation. This section contains a series of short evaluation reports on Fast Track I and II and Section 11 contains an overall evaluation report of Fast Track I. The formative evaluations were not, in general, repeated for Fast Track II. Dr. Herman Torge, from the Center for Educational Services prepared the evaluation reports in Sections 10 and 11.

Evaluation Report #1

Chemistry Track Scholarship Awards Meeting

November 19, 1976

The meeting was called by the project director, Carol Shaw, for the purpose of reviewing the applications and making final decisions on awards for the chemical engineering track. In attendance were Bernard Rice (mathematics), Bernhard Schmidt (electrical), Ronald Servais (chemical), Carol Shaw and the Evaluator.

Prior to the meeting the applications had been sent to Rice, Shaw and Servais for evaluations. The compilations were presented at the meeting for discussion.

The ensuing discussion centered on the weak mathematics backgrounds of a number of the applicants, especially those interested in the chemical track. The cause for this was attributed to (1) the brochure which did not indicate that mathematics majors could enroll in the chemical track, and (2) the ability of students to graduate from an institution of higher eudcation with a degree in chemistry and with little or no mathematics being required.

Several steps to ameliorate this problem were taken:

1. Those applicants who were especially deficient in mathematics would be rejected even though the number of participants in the project fall below the goal set.
2. Discussions would be held with several who had borderline mathematics backgrounds to make them aware of the

problem and how they might correct it.

3. Tutoring would be available.
4. Special attention would be given to this situation in the first weeks of the mathematics course for possible course changes and revisions.
5. Attempts would be made to review the electical applicants, all of whose math backgrounds were better, with the hope of having some volunteer to change to chemical.

Three applicants were rejected; fourteen were accepted. Acceptance letters were sent. Rejections included reasons for the rejections. Letters of acceptance included suggestions for personal contact and also pointed out any area of potential weakness in order to alert the applicant to the problem and provide for a period of adjustment.

Evaluator comments: Excellent meeting, good discussion. Perhaps an even greater stress on personal contact with applicants would be in order.

Evaluation Report #2

Electrical Track Scholarship Awards Meeting

November 23, 1976

The meeting was initiated by the project director, Carol Shaw, for the purpose of making decisions on the electrical engineering fast track scholarship awards. In attendance were Bernhard Schmidt, Bernard Rice and Shaw.

Prior to the meeting all applicants had been reviewed individually by Shaw, Rice and Schmidt. Each of the some 30 applicants was discussed, ratings compared, transcripts reviewed and application forms read again if necessary. Twenty-four awards were made since it was felt that several, because of indicated financial problems, would not accept.

A letter of award was also reviewed and approved. Additional comments were to be added to some letters as special circumstances dictated.

Evaluator comments: A good and thorough review of the applicants. The only problem that could have resulted from the decision to send twenty-four award letters was that all applicants accept. This then, would have necessitated a request for a change in the project. The maximum number of students that could be handled in each track was proposed at twenty.

Evaluation Report #3

Industry Representative Meeting

December 15, 1976

A meeting was held December 15, 1976 at 11:00 A.M. with industry representatives and the project director.

The purpose and a brief overview of the entire Fast Track Program were presented to those in attendance. Discussion focused on industry's role during the Motivational and Diagnostic Week.

The role of industry was proposed to be one of encouragement to women that they can become good engineers, that industry does encourage women in these roles and, by example, to show that women are now functioning in this capacity.

It was also suggested that those industries chosen for this presentation have good records in this respect.

Note: The project director also indicated that because of the excellent mathematics backgrounds of some applicants, advance placement would be offered. Curriculum guides were revised accordingly.

Evaluation Report #4

Final Planning Session

January 4, 1977

The final planning session for the Fast-Track Program was called by the project director Carol Shaw. Others in attendance were Dr. Bernhard Schmidt, Dr. Ronald Servais and the evaluator.

Items on the agenda were presented, discussed and resolved. The major part of the meeting was given over to the final item "The Summary Report of Students in the Two Tracks."

The total of 20 students per track had not been realized even though countless phone calls and numerous personal interviews were made with potential participants. The two primary reasons given for hesitancy by applicants to enter the program were fear of failure or lack of self confidence to complete the project, and financial problems in not being able to support oneself during the term of the project.

Personal contact by the project director did much to eliminate the "fear of failure" problem and it was expected that the Motivational Week activities would dispel most of that remaining. It was also suggested that an area be set aside for the students where they could work, study, and generally be together to informally react with one another on mutual problems.

The project director began spending a great deal of time in finding or assisting in finding part-time employment for a number of the participants. Several part-time positions had not been located.

Evaluator comments: Herein are two weaknesses of the project, both of which contributed to less than maximum participation. More personal contact, and at an earlier time, might have helped in eliminating some of the lack of self-confidence. To do this an earlier mailing and publicity campaign and more time in the project alloted to the project director (or the designate) for this purpose would be necessary.

The financial problems of the applicants could have been partially eliminated by awarding an additional stipend to each participant to help defray living expenses. This type of award is not uncommon and makes sense in view of the goals of a career facilitation project, especially if the project wishes to attract persons who are degreed and are thus not working. Qualified, Program applicants for the Fast-Track were not self-supporting and in many instances not of the immediate area. It appears that many applicants will not be able to continue in the project without some support. Employment will restrict their activities outside the regular classes, but should contribute generally to program objectives. It is suggested that for future projects of this nature, the National Science Foundation seriously consider stipends.

Evaluation Report #5

Interview with Dr. Ronald Servais

January 12, 1977

The curriculum for the chemistry track was developed under the administration of Dr. Ronald Servais. It is based on the Monsanto project which was developed by the Department of Chemical Engineering. The purpose of the Monsanto project was to move persons from pure to applied research in chemistry, a change very similar to moving persons from chemistry to chemical engineering.

A major adjustment in the curriculum was made in the mathematics area when it was discovered that those persons entering the chemistry track were not sufficiently trained in mathematics. The first course in mathematics will be more basic than originally planned. This will not hamper the sequence of courses since math applications will not come until later.

The curriculum has been structured to meet the special needs of the group. Several of the courses (499 courses) are tailored for the individual. The method of instruction is to be fairly traditional, the courses being sequential in nature.

Evaluation Report #6

Interview with Dr. Bernhard Schmidt

January 12, 1977

The curriculum for the electrical track was developed by Dr. Bernhard Schmidt. Unlike the curriculum for the chemistry track, the electrical has been tailored specifically for the project, and for the women coming into this particular track. Most students accepted for this track are quite advanced in mathematics and in some instances will be able to test out of the first mathematics course.

This high proficiency in mathematics will be a definite advantage to the student. Electrical applications and terminology will be that which needs to be learned.

The courses in the electrical track will be primarily self-paced. The department in its regular program has been using that methodology with considerable success. It seemed logical to apply it here.

An inspection of the material for the courses shows a well developed course of study and outline of content. The curriculum seems well planned and ready to implement.

Evaluation Report #7

This evaluation report is of Phase One of the Fast-Track program, that period of time from project approval by NSF to the beginning of the Motivational and Diagnostic Week.

The primary goals of this period of time were:

1. Curriculum Development
2. Recruitment
3. Diagnostic Procedures

The goals of the project for this period of time have been realized. The curricula for both the chemical and electrical tracks have been finished, including revisions brought about by a diagnosis of the backgrounds of the selected participants. The revisions consisting primarily of adjusting course content to the mathematics capabilities of the groups.

Recruitment procedures followed those outlined in the project narrative; mailing of brochures to persons on lists procured from universities, press releases, and announcements to various organizations. Application forms were given to persons requesting them. The final selection of applicants was made through a review committee consisting of the chairmen of the Chemical Engineering and the Electrical Engineering Departments and the project director. Each committee member made individual assessments of the applicants following a rating plan suggested by the project director. These ratings were combined and discussed for final selection and approval.

A review of each applicant's backgrounds made some curriculum adjustment necessary, primarily in the mathematics areas. Additional emphasis was also to be placed on the Motivational Week in order to instill confidence which the project director feels is lacking. Applicants exhibited some reservations and doubts about their abilities to successfully complete the work.

Two other adjustments were made in the project. An assistant was hired because of the amounts of work during the recruitment phase. During this period the curriculum was finalized and the planning and development of Phase Two began.

In addition, the project director had to spend considerable time making financial arrangements for the successful candidates since most were from outside the immediate locality and would have limited means of support during their participation in the project.

All goals and objectives of Phase One of the project have been met.

EVALUATION REPORT #7

Fast-Track Late Entry Program
for
Women in Engineering

Motivational-Diagnostic Week

January 18-21, 1977

Phase Two of the Fast-Track Late Entry Program began with the Motivational-Diagnostic Week (January 18-21, 1977). The purpose of that week was to provide "a series of experiences designed to provide psychological reinforcement" to the women entering the program. In the previous evaluation reports it was noted that the problem of confidence on the part of candidates was of concern to the project staff. The activities of the week were designed to provide positive motivation to the candidates. In addition, some diagnostic activities were scheduled to provide information for final curriculum changes.

The activities of the week are listed on the enclosed program.

At the close of the week's activities, each participant was requested to complete an evaluation form (enclosed). The purpose of the evaluation was to have the participants rate the various activities. In addition, they were requested to respond negatively or positively to various concerns expressed prior to program entry and how they felt about these concerns upon completion of the week's activities.

Findings

I. Four statements referring to the week in general were

rated by the participants. The statements and resulting ratings are shown as follows.

1. The organization of the week's activities was:

   Excellent 1 2 3 4 5 6 7 Poor

   Mean=1.45
   Standard Deviation=.62

2. The objectives of this week were:

   Clearly Evident 1 2 3 4 5 6 7 Vague

   Mean=1.48
   Standard Deviation=.57

3. The work of the panels and consultants was:

   Excellent 1 2 3 4 5 6 7 Poor

   Mean=1.61
   Standard Deviation=.80

4. Overall, I consider this week:

   Very Helpful 1 2 3 4 5 6 7 No Benefit

   Mean=1.45
   Standard Deviation=.68

II. Participants were also requested to rate the five major components of the week by using a scale of one to four.

1 - Excellent, a grat deal of help
2 - Good, helpful and useful
3 - Fair, of some benefit
4 - Not much help

The findings are as follows.

Panel Discussion of Women in Engineering (Tuesday A.M.)

Mean=1.68
Standard Deviation=.72

1 = 12
2 = 14
3 = 1
4 = 1

Faculty Panel: Nature of Chemical and Electrical Engineering (Tuesday A.M.)

Mean=2.07
Standard Deviation=.60

1 = 4
2 = 18
3 = 6
4 = 0

Round Table Discussion with Industry (Tuesday P.M.)

Mean=2.11
Standard Deviation=.79

1 = 7
2 = 11
3 = 10
4 = 0

Career Management Training Program (Wednesday & Thursday)

Mean=1.32
Standard Deviation=.54

1 = 22
2 = 8
3 = 1
4 = 0

Individual Consultation with Faculty (Friday)

Mean=1.77
Standard Deviation=.77

1 = 13
2 = 11
3 = 6
4 = 0

III. In a third section of the questionnaire a number of statements were presented for response by the participants. (These statements were the results of concerns previously expressed by candidates to the project director.) Each participant was asked to respond as they felt prior to the week's activities and as they felt at the end of the week.

Would you please consider your thoughts prior to beginning this week and as you might feel now, concerning the items listed following. If you felt good and had positive feelings use the letter "P," if it was of some concern or worry use the letter "N." If not applicable, leave blank. Feel free to add items or thoughts not listed.

Your reaction BEFORE		Your reaction NOW
_____	1. My relationships with other women in the program	_____
_____	2. Financial concerns	_____
_____	3. Job prospects upon program completion	_____
_____	4. My ability to manage school and out of school responsibilities	_____
_____	5. My ability to successfully complete the program	_____
_____	6. My educational background	_____
_____	7. Just what does "engineering" mean	_____
_____	8. Did I make the right decision	_____
	9. Other:_____	
_____	_____	_____

The responses to these statements follow. They are divided, for each statement, into the four possible "BEFORE-NOW" combinations, with "P" signifying "positive" and "N" showing "negative."

STATEMENT	BEFORE-NOW RESPONSES*			
	N→P	P→N	N→N	P→P
1.	15			11
2.	4		16	8
3.	12			14
4.	7		5	18
5.	10	1	3	16
6.	6	2	7	13
7.	10		7	8
8.	13		1	13

*One questionnaire could not be tabulated.
Not all participants responded to each statement.

In addition, two statements were written in, both appearing in the N→P category. One spoke to the organization of the Fast-Track Program and the other to housing concerns.

IV. Finally, all participants were invited to submit comments on the activities of the week as well as comments or suggestions for the good of the entire Fast-Track Program. The response was excellent. All are included as written.

COMMENTS BY PARTICIPANTS

1. The session with the career management training women were excellent. It helped women to realize their conditioned negative responses. It helped women in the program to realize the hesitations, concerns, etc. they had, other women also had.

2. My reactions to the career management workshop was a + neutral for I'd already been to similar workshops, feminist C.R. groups and read anything I could get my hands on. The question is putting it into practice in real life situations. They should have stressed that it won't come overnite and one really needs years of practice. I'm also skeptical of the requirement that the focus group should meet once a week and doubt that this will last very long.

3. Everything happened a little too fast and at a bad time of year. I had a lot of trouble making contact at the university.

4. I felt absolutely positive feelings about activities held every day except Thursday. Wednesday nite I went home feeling great about ideas learned at the career management program but Thursday left me feeling depressed and disgusted. I think it was mainly due to the following reasons:
   1) The panelists assumed that none of us had ever attempted to better ourselves. Or worse yet, that we had never even thought of it.
   2) The workshop dealt with all positive aspects. I thought we could all use some help in dealing with how to handle negative situations.

   I only had these feelings after Wednesday's sessions. A program cannot be geared to suit every individual 100%. I realize now that I should have helped other individuals get more out of the program in those areas that I didn't feel suited me.

5. I never expected the orientation week to be so helpful in adjusting to the program.

6. The week's activities gave me a much more positive attitude toward the year ahead. I had been thinking of the year only as a means to achieve an end. Now I feel that the year might be enjoyable as well as successful. I think Carol and Nancy did an excellent job of preparing the program.

7. I felt that this first week was necessary for motivation for the group as a whole. Before the week, I thought it would be lectures and forms. Much to my delight this was not the case and I am really excited about the year to come.

8. Meeting with the panel of women engineers was fantastic, and Adele and Bev's program reinforced the very positive feelings

I began to have. An excellent beginning!

9. During this week I learned a lot about the field I am entering and the purpose of doing this course.

10. Suggestions for the good of the program:
    1) If another program of this type is planned, it should begin in the fall rather than in January;
    2) Housing assignments should be made earlier and women who share houses should be given each other's names in order to avoid bringing many of the same household items;
    3) A list of some places for socializing with other UD students might be appreciated.

11. I think this week was fantastic. It was so organized and obviously well-planned. I would have felt so lost and nervous in my classes if I had not had this week to get to know the other girls and to realize that everyone is feeling nervous and insecure. I feel so much more confident and comfortable having been able to participate in all the activities of the past week. I really appreciate the time and effort it took to put it all together.

12. This week's activities have been invaluable to me in preparing for the year ahead. It has dealt with the specific concerns and doubts bothering me, therefore preparing me better to concentrate on coursework. Especially helpful was the forming of focus groups for support in the future.

13. I don't think I'm capable of evaliating now. After seven weeks I'll know how helpful the past week has been.

14. The whole idea is fantastic and I appreciate all of the work that has gone into it. The turning point for me in deciding the program and chemical engineering was for me was Dorothy Bowers. I felt she added an awful lot to the program and any future programs of this sort should, if possible, involve her.

15. This week has been very postitve and motivational. I feel much more confident of myself and more optimistic toward the engineering career field. If we had not had this week, I feel that many of us would have had psychological problems in this program. Thanks for having this insight for this motivational week. It was great. You did a good job.

16. After getting into the program a little, I would like to have a women engineers panel again because now I have a better idea of what to look for in their talks.

17. The week went fast. I would have liked more interaction with the other women.

18. I would like another workshop with Bev and Adele later in the year to keep the concepts of support groups that they taught clear and functioning. Hearing from the women panelists was very helpful

to me. Dorothy Bowers was tremendous and although I learned a lot from the woman from Monsanto I was very uncomfortable with her attitude toward women. I am excited about working with a group of women who are so sharp and interesting.

19. I am more enthusiastic about the program than I was before the move. The people, both staff and colleagues, have inpressed me with their friendliness ard concern.

20. The career management training was absolutely great. I think more emphasis needs to be placed on working together. I still feel a reluctance with some of working together in problem sessions.

21. Career Management Training Program was a good idea so we work together instead of compete.

22. I was more worried this week about housing and transportation than about self-image and goal setting. I still don't have a clear-cut image of what the functional reality of being an engineer would be like, although one of the company interviewers did bring in a board with a micreprocessor on it and some of the accompanying diagrams. The representative from Teachology Incorporated was enthusiastic about his work. The interviews with the company representatives led me to believe that there were at least some interesting jobs, but they left me wondering about the engineer's place in the business hierarchy. The technician/management schism has me particularly worried. I would only want to work for a company where my job was treated with dignity and respect. I would not want to be where engineers were considered a bought commodity. In discussing managerial skills and engineering skills one of the representatives said, "I can buy engineers, I can not buy managers." I would also have liked to see the possibilities of independent contract work discussed.

23. I feel that this week will serve as a very positive force in the success of the program. It gave me a chance to become adjusted to this new environment and to new people in a very relaxed and enjoyable manner. This would have been very different if I had come here and begun classes right away. It is now Friday morning January 21, 1977 at 6:30 a.m. and I am on an enormous high. I have just completed a 10-hour workshop given by two fantastic social engineers from Los Angeles--Beverly Kaye and Adele M. Scheele-- and I feel like the world is mine to conquer; that my possibilities are almost limitless and I can create a lifestyle that will give enormous satisfaction and recognition. I lost three pounds this week without even trying. I didn't need food to calm my nerves. For instance, one day for lunch I dipped elegantly from a bowl of strawberry frozen yogurt instead of my usual habit of grabbing a greasy hamburger and a hunk of chocolate layer cake. I was on a high of ideas--experiencing, doing, meeting new people, enjoying, enjoying--thinking positive, being positive--getting to know me.

Thank you Beverly; thank you Adele; an infinite number of thank yous to that wonderful, amazing dynamo, Dr. Carol Shaw and to a beautiful, together, interesting Nancy Cook Cherry. I am thankful for people like you in my resource network. You will be invaluable to me in the future. Whenever things get rough and I become discouraged, images of you will flash into my mind, reminding me of the promises I made myself and the fact you guys thought I could, so I can.

Conclusions

On the whole, the results of the questionnaire show positive responses. The organization of the activities was rated high, the objectives were clear, the consultants well received and, above all, the participants felt the week to be helpful.

Of the five segments of the week's program, the Career Management was rated highest. Comments by the individuals bear this out. Respondents were somewhat lukewarm toward the Industry Round Table. One comment made on this indicated a desire to do this later when they had been in the program. It was felt they would know better then what to listen for and the kinds of questions to ask. The individual consultations on the final day received positive response, showing again the need of the participants to have individual contact as a means of motivation.

The activities of the workshop did much to move the attitudes of the individuals from the negative to the positive as evidenced by the tabulations in Table I. Nevertheless, close attention must be paid to those areas where negative attitudes and concerns still exist. Foremost of these are "financial concerns." Managing school and home responsibilities, success in the program and background are still concerns of a few.

Evaluator Comments: It is suggested that a note be placed in each student's file noting the area(s) of concern. Periodic checks with the student might be of help. It is also suggested that the latter part of the questionnaire be administered again after the second term to assess changes that have come about.

It is further suggested that the written comments be reviewed by the project director for ideas or suggestions that might be incorporated for the good of the program.

Herman Torge
January 27, 1977

ADDENDUM

STUDENT CONCERNS

FAST-TRACK PROGRAM

STUDENT	CONCERNS
#1	Financial
#2	Financial, Educational background
#3	Financial
#4	Financial, Educational background
#5	Financial, Meaning of "engineering"
#6	Financial, Meaning of "engineering"
#7	Financial, Educational background
#8	Financial, Meaning of "engineering"
#9	Financial, Educational background
#10	Financial, Managing of school and out-of-school responsibilities; Educational background; Ability to complete the program
#11	Managing school and out-of-school responsibilities
#12	Financial
#13	Financial, Meaning of "engineering"
#14	Meaning of "engineering"
#15	Financial, Educational background
#16	Financial
#17	Meaning of "engineering"
#18	Ability to manage school and out-of-school activities; Ability to complete program; Educational background; Meaning of "engineering"; Did I make the right decision

STUDENT	CONCERNS
#19	Financial, Educational background
#20	Managing school and out-of-school responsibilities
#21	Meaning of "engineering"
#22	Financial; Managing school and out-of-school responsibilities; Educational background; Ability to complete program

FAST TRACK PROGRAM EVALUATION REPORT

Special Projects Motivational Week - Fast Track I

As an adjunct to the regular program of course work, an occasional session is held for Fast-Track students, a session designed to meet a more specific need as requested by the student(s). Two such meetings have taken place

March 22, 1977 Study Skills and Testing,

April 18, 1977 Ways Out of Depression.

A brief questionnaire was handed out at the second session for an evaluation of both sessions. Only twelve returns were received. Only half evaluated the first session, all evaluated the second session.

The tabulation of the data is shown following.

Testing

	Very Useful 7	6	5	4	3	2	1 Not Useful
Chem. E.			1			2	
Elec. E.		1	1		2		

Study Skills

	Very Useful 7	6	5	4	3	2	1 Not Useful
Chem. E.			1		1	1	
Elec. E.		1	1	1	1		

Ways Out of Depression

	Very Useful	7	6	5	4	3	2	1	Not Useful
Chem. E.				2	2				
Elec. E.		1	3	1	2	1			

Because of the small number of respondents, no attempt has been made to do anything other than display the data for Testing and Study Skills. Since all respondents answered Ways Out of Depression, a Mean was computed.

Track	Mean	SD
Chem. E.	4.50	.58
Elec. E.	5.12	1.36
Total	4.92	1.16

A general observation would be that the sessions attract the Electrical Track students more and that they find them more useful. Perhaps the sessions have meaning only to a few students and others either do not attend or tend to rate them lower because of disinterest.

EVALUATION REPORT

FAST TRACK II
MOTIVATIONAL DIAGNOSTIC WEEK

JANUARY 8-12, 1979

Phase II of the Fast Track II Program began with the Motivational Diagnostic Week, January 8-12, 1979. The broad goal of this week was to provide a series of experiences, both motivational and diagnostic, which would give the participants a positive reinforcement to their decisions to enter the program. A copy of the program is enclosed.

At the end of the week, each participant was given an evaluation form and asked to rate the activities in which she had participated. In addition, each participant was also asked to respond to various concerns expressed prior to program entry and which had also been present during Fast Track I.

Findings

I. Four statements pertaining to the general organization and operation of the week were presented for the respondents to rate. The statements with the mean rating and standard deviation are shown following:

1. The organization of the week's activities was:

Excellent						Poor
1	2	3	4	5	6	7

Mean = 1.74
Standard deviation = .73

2. The objectives of the week were:

Clearly Evident						Vague
1	2	3	4	5	6	7

Mean = 1.84
Standard deviation = .89

3. The work of the panels and consultants was:

Excellent						Poor
1	2	3	4	5	6	7

Mean = 1.79
Standard deviation = .65

4. Overall, I consider this week:

Very Helpful						No Benefit
1	2	3	4	5	6	7

Mean = 1.59
Standard deviation = .75

II. Respondents were also asked to rate the various sessions of the week using the following scale:

1 - Excellent, a great deal of help
2 - Good, helpful and useful
3 - Fair, of some benefit
4 - Not much help

Industry Panel: Employment opportunities; Needed skills; Career paths of successful women. (Monday A.M.)

	Electrical	Chemical	
1 =	4	4	
2 =	9	11	Mean = 1.94
3 =	4	2	Standard deviation = .65
4 =			
NA =	4	1	

Dayton Tour (Monday P.M.)

	Electrical	Chemical	
1 =	1	1	
2 =	0	5	Mean = 2.93
3 =	8	5	Standard deviation = .87
4 =	5	2	
NA =	7	5	

Faculty Panel: What Do Chemical and Electrical Engineers Do? (Tuesday A.M.)

	Electrical	Chemical	
1 =	6	3	
2 =	6	9	Mean = 2.2
3 =	7	6	Standard deviation = .86
4 =	2	0	
NA =	-	-	

Individual Consultations with Faculty (Tuesday & Friday P.M.)

	Electrical	Chemical	
1 =	1	4	
2 =	9	6	Mean = 2.38
3 =	3	4	Standard deviation = .94
4 =	1	4	
NA =	7	-	

Professional Development Workshop (Wednesday & Thursday)

	Electrical	Chemical	
1 =	17	16	
2 =	3	2	Mean = 1.18
3 =	1	-	Standard deviation = .45
4 =	-	-	
NA =	-	-	

Fast Track I Panel (Friday A.M.)

	Electrical	Chemical	
1 =	15	15	
2 =	5	3	Mean = 1.28
3 =			Standard deviation = .42
4 =			
NA =	1	-	

III. Responses to the statements in this section were tabulated according to the four possible combinations. The letter "P" signifies a positive feeling, the letter "N" signifies a negative feeling and the arrow (⟶) shows the direction of the feeling, the first letter (N or P) being the way respondents felt before they arrived and the second letter indicating the feeling at the end of the Motivational Diagnostic Week.

	N⟶P	P⟶N	N⟶N	P⟶P
1. My relationship with other women in the program	25	-	-	11
2. Financial concerns	2	1	14	15
3. Job prospects upon program completion	12	-	1	25
4. My ability to manage school and out of school responsibilities	11	1	7	17
5. My ability to successfully complete the program	13	-	2	24
6. My educational background	8	-	-	28
7. Just what does "engineering" mean	12	-	4	18
8. Did I make the right decision	19	-	2	18
9. Family and/or spouse support	-	1	1	33
10. Employer advice or support	3	-	4	14

IV. On the pages following the conclusions are the comments offered by the participants.

Conclusions

The findings of the survey indicate positive reaction to the activities of the Motivational Diagnostic Week. The mean responses to the organization and operation of the week ranged from 1.84 to 1.59 indicating that participants thought the week was well planned and executed.

When asked to rate the various sessions on a scale of 1 (excellent) to 4 (not much help), those sessions indicated as being most helpful were:

1. Professional Development Workshop (Mean 1.18)
2. Fast Track I Panel (Mean 1.28)
3. Industry Panel (Mean 1.94)

That which was least helpful was the Dayton Tour (Mean 2.93)

A review of the data presented in Section III shows that with one exception, the participants for the most part are positively oriented. The largest numbers of negative feelings were reversed by the end of the week and few negative feelings or concerns remained.

The exception to this is in the area of finance. Although 17 of the 32 respondents did not consider finance a problem by the end of the week, this is still a concern for the other 15 persons.

Herman Torge

COMMENTS BY PARTICIPANTS

1. As a whole, Motivational Week provided a great transition period between my old life and beginning studies.

2. The activities this week went well. Wednesday and Thursday were high spots for me as I began to feel at ease and accepted. Many of my academic concerns are no longer a problem for me. Finances may be although there will be nothing the University of Dayton or the Fast-Track program could do. On the whole, the motivational week was well worth the effort.

   The industry panel probably would have been excellent had there been more panelists; this, of course, was not the fault of anycne.

   If a Job Fair is not scheduled for our group, I think it should be given some though since it sounds like an excellent opportunity for all concerned.

   Thanks for an interesting week!

3. My major concerns dealt with my abilities in handling the program knowing my weak areas. Most of these fears have been eliminated and I'm getting very excited about the prospect of starting and completing the program.

   I have greatly appreciated the Motivational Week activities. I already feel close to many other women in the program. This has certainly reduced the trauma of moving to Dayton and being so far away from my family and friends. My feelings now are very positive and I can't wait to get started! Thanks!

4. I think the whole week was very well done.

5. Dr. Scheele, bravo!

6. I liked the feeling of welcome from everyone.

7. Dr. Scheele was fantastic! Would it be possible for her to visit us again before our program is over? I'm sure we could all use the reinforcement.

8. I understand that our group events (especially social events) were designed to help us get to know one another-and that was extremely successful-but, I hope, that husbands will be invited to future social events. My husband will work almost as hard as I will this year-he has a stake in me-including him in activities might encourage his support.

   I'm not terribly excited about our "mandatory" support groups-I prefer to choose my own friends. I have been extremely impressed with the people here-both staff and Fast Trackers - and how supportive and friendly they are.

9. The industry panel could have been more complete.

   The greatest value of Tues. A.M. Faculty input was getting to "meet" them.

   Wed. & Thurs. facilitated our group interactions-of very great value!

10. I wish I'd had just a little more spare time to house-hunt, arrange living conditions. I am still worried a lot about finding work so I can support myself through the program. I really do appreciate the kindness and thoughtfulness of having the temporary housing available in Alumni Hall.

11. Major concern: Development of career and family simultaneously: Timing, hiring of help, maternity leaves, child raising.

12. Excellent week... well-planned and with excellent participants. A few few more 5-10 minute breaks would be helpful for those of us who have trouble sitting for several hours.

13. If at all possible, applications and acceptances should occur earlier. It is very difficult to leave job and home in just one month.

14. I think my reactions to the first week's activities would have been more enthusiastic if:
    a. The first day had not been so long. Tuesday or Wednesday would have been a better day for the dinner trip.
    b. I were personally more responsive to workshops.
    c. I had not been surprised to discover that I needed extra requirements for my BSEE. My acceptance letter led me to believe I would receive notice by mail prior to this week if I needed additional courses.

    But I still have an overall positive feeling about the program. And even though the separate aspects of the first week did not rate highly on my sheet, the week as a whole ranked high only if it accelerated the "getting to know you" process.

15. I was disappointed that I was not able to attend Monday's lectures, as I heard so many good things about the introduction and it would have been helpful to more clearly understand the Motivational Week objectives as then stated. The most useful portion of the program was the achievement of a cohesive, supportive group of women through the group activities such as those directed by Adele. The Fast Track I panel tended to more clearly answer the question posed on Tuesday to the faculty of what the Chem. and Elec. Engineers do. --You might want to use the faculty in a different manner in Fast Track III...maybe to allay some of the fears the women have about the curricula or to reinforce the idea that we will be qualified engineers when we complete this course. The consultations with the faculty are a good idea-but might be of more use to us after classes have started-although I realize that a few weeks into the semester these people will be very busy and may not have as much time to assist us with problems arising later in the year.

    When finding that it was necessary to complete 6 hours of philosophy to receive my BSEE degree, I wanted to know the options around this problem... I did not find my answers within the department and, determined to find out "the score", I looked elsewhere. Though I like to work within my department, I also believe clear answers should be given rather than to be told not to worry about the situation. Maybe during Fast Track III these requirements of Philosophy and Physical Chemistry could be known a semester ahead of time so that, not only could the requirements be taken care of, but, more importantly, the women might have a taste of classroom life

earlier and a more gradual transfer from the working world to the classroom realm might be made (I realize that due to the late dates that you might receive funding, etc., you may not be able to notify your new students so far in advance).

Overall, this introductory program has been most helpful in meeting and developing friendships with the other Fast Track students; in allaying my fears as to the course of study; to myself as a product of the Fast Track program, and as to what will be expected of me in post-Fast Track vocations; and in learning to be comfortable in Dayton (away from the familiar).

I can see that an extreme amount of fore-thought has been put into this program...For your concern about our psychological growth as well as our professional and educational growth, I thank you and am extremely grateful.

SECTION 11

OVERALL EVALUATION - FAST TRACK I, Herman Torge, Ph.D.

Introduction

Evaluation activities for the Fast Track Program were conducted by an external evaluator. Each evaluation activity upon its completion was reported to the project director as soon as possible for review and use. Only several terminal evaluations were not handled in this manner. Thus the reports in this chapter tend to be abbreviated from the original ones given to the project director.

It should be noted that the evaluator, the Office of Educational Services, was not involved in the original evaluation as presented in the proposal, but coming on the scene later, at which time negotiations were carried out and the evaluation design developed. This design was carried through with some changes and consisted of the segments presented following this brief introduction.

Planning, Recruiting, Selection

During the first months of the project, from late summer to early January, the project carried out the necessary tasks of planning (both curriculum development and administrative planning), recruiting and final selection. The evaluation of this part of project consisted of selected observations of staff meetings and discussions with the project director and department chairmen.

Findings

Curriculum planning and development was extensive. Less so for the chemical track which had the advantage of previous trial through the Monsanto project. For the electrical track, since the curriculum had to be restructured, the courses were designed toward a self-paced methodology. Later adjustments were necessary because of the unforeseen high math proficiency of the electrical students and the less than expected math capability of the chemical students.

The recruitment of potential participants was carried on through the mailing of brochures to persons on lists provided by universities. Press releases and announcements to various organizations and their publications were also used.

The selection process consisted of independent reviews of applicants' files by the project director, the department chairmen and the mathematics instructor. After the independent rankings were tabulated, each applicant was discussed and final selection made.

Conclusions

The objectives set for this segment of the project were met. Several adjustments were made to accommodate unforeseen circumstances. The quota of students was not filled because of lack of qualifications. Because of the math backgrounds curriculum adjustments were made. The unanticipated work load of the project brought about the decision for an assistant to the project director. The short time span of this part of the project brought on last minute applications and selection.

The successful candidates for participation met all or most of the criteria for selection. They were college graduates with majors in math, chemistry or physics. They ranged from recent graduates to nearly fifteen years back. They were either unemployed, underemployed, unable to expand their horizons or simply dissatisfied with their jobs. In age they ranged from under thirty to mid-forties and from single to married with grown children.

Motivational Diagnostic Week

This week, prior to the beginning of academic classes, was designed to help the women "reinforce their feeling that they can 'make it' and that they belong in the field of engineering." In addition to this, they were also given the opportunity to take a math placement test. The activities included contact with women engineers, contact with faculty, contact with industry representatives and an extensive workshop on career management.

Evaluation activities consisted of limited observations and a survey questionnaire completed by the program participants at the end of the week.

Findings

Participants rated the week to be an excellent experience, well organized and helpful. On a seven point scale from excellent (1) to poor (7) the following were the averages on the general context of the week.

a.	Organization	Mean 1.45
b.	Clarity of objectives	Mean 1.48
c.	Panel and consultants	Mean 1.61
d.	Overall rating	Mean 1.45

The components of the week's activities were for the most part rated as being quite helpful. Using the scale points of "excellent, good, fair or none" the respondents provided for the following data:

a. Panel of Women in Engineering:	Excellent	12
	Good	14
	Fair	1
	Poor	1
b. The Nature of Engineering:	Excellent	4
	Good	18
	Fair	6
	Poor	0
c. Industry Roundtable:	Excellent	7
	Good	11
	Fair	10
	Poor	0
d. Career Management:	Excellent	22
	Good	8
	Fair	1
	Poor	0
e. Faculty Consultations:	Excellent	13
	Good	11
	Fair	6
	Poor	0

A number of concerns had been voiced by the women to the project director prior to the beginning of the program. These were presented in brief statements to which respondents were asked to indicate their feeling prior to the Motivational Week and at the end. Considerable change took place as the data following show. The concerns of the participants were also incorporated into a survey instrument administered several times throughout the year.

TABLE 10

ATTITUDES ON SELECTED ITEMS BEFORE AND AFTER THE MOTIVATIONAL WEEK

Concern	Before		After	
	Negative	Positive	Negative	Positive
1. Peer relationships	15	11	0	26
2. Financial concerns	20	8	16	12
3. Post-program job prospects	12	14	0	26
4. Managing school and home responsibilities	12	18	5	25
5. Ability to complete program	13	17	4	26
6.. Personal educational background	13	15	9	19
7. Meaning of engineering	17	8	7	18
8. Decision to enter program	14	13	1	26

Conclusions

The data presented above show the Motivational Diagnostic Week to be of considerable importance to the project and to the persons in it. It was well organized and presented experiences which had meaning to the participants. Of the various segments of the week the Industry Roundtables were the weakest, due perhaps to the lack of understanding of engineering by the women. The Career Management segment rated very high. Written comments indicated, that program participants were extremely generous in their praise of these consultants.

Although some negative concerns still existed at the end of the week considerable change took place. These concerns, while they improved somewhat, remained throughout the year.

Individual and Group Assistance

In order to assist the women toward the successful completion of the program, numerous sources of help were available both on an individual and group basis. Only selected activities were evaluated. A partial list of services included:

a. Focus Groups
b. Problem Solving Sessions
c. Seminars on Selected Topics
d. Counseling and Psychological Services
e. Finding Part-time Employment
f. Visiting Engineers
g. Career Education

Findings

The Focus Groups were formed as a result and requirement of the Career Management activities during the Motivational Week. Small groups of four to five persons were organized. They were to meet regularly to discuss common conerns (preferably non-academic) and to provide positive motivation through peer reinforcement. A survey conducted six weeks into the project found that:

a. the group did not meet regularly; some not at all
b. attendance was erratic;
c. eleven persons had never attended.

The reasons given showed that persons within some of the group lacked common ground (except the academic program), that most discussions centered around classwork, and that the women felt they had enough to do and were too busy to meet with a group that they felt had limited usefulness.

The Problem Solving Sessions were available during the day for academic assistance to those who wanted it. A survey taken after four weeks showed that six people had not taken advantage of this assistance. These people indicated they felt no need for help and were doing well without it. Those who took part indicated the sessions were helpful and that they received the individual attention they needed. Most of the work in the sessions focused on the chemical track, thus several electrical persons indicated the need for help. Later interviews with students indicated satisfaction with the first tutor (female) in the Problem Sessions but dissatisfaction with the second tutor (male), citing lack of cooperation and empathy.

Two Sessions were offered, one on "Study Skills and Testing," and the other entitled "Ways Out of Depression". A brief survey brought in only seven returns for the first session and twelve returns for the second. On a seven point scale from "Not Useful" (1) to "Very Useful" (7) the following average rating was calculated.

Study Skills	Mean 4.0
Testing	Mean 3.7
Ways Out of Depression	Mean 4.9

Assistance in Finding Part-Time Employment was an unanticipated task for the project director. Because of the lack of financial stipends it became necessary for some persons to find work in order to stay in the program.

A Career Education course was developed and offered during the second half of the project year. This is covered in Chapter Three of this report.

Conclusions

That the Problem Sessions were of value and an important part of the program is evident by the data. Many took part, those who did not felt no need.

The rather quick demise of the Focus Groups would lead one to question their usefulness. The incongruence between the enthusiasm of the Career Management Workshop and the lack of it for the Focus Group would seem to indicate a need to examine critically this segment of the program.

The other sessions were initiated because of a perceived need by the project personnel. Attendance was limited and participant evaluation of their usefulness was lukewarm.

Attitudinal Survey

Introduction

Three times during the project, April, June and December, an extensive questionnaire was given to the participants. Its purpose was two-fold. First it requested information of the participants about their activities, how they perceived themselves to be progressing and other factual information. Second it requested information on a number of factors that might have an effect on their program participation. The latter was a result of items so indicated in the Motivational Week questionnaire and were included in each questionnaire for the purpose of following any change made.

Findings

Encouragement to be a part of the Fast Track Program came

from a variety of sources. Of the twelve married persons, all received positive to very positive support from their spouses. Those who had jobs, and whose employers were aware of the intent to enter the program, received support from their employers (8 out of 10). For those who were unemployed there was the incentive of a possible job after completing the program. For those who were employed, present job satisfaction was relatively low and opportunities limited.

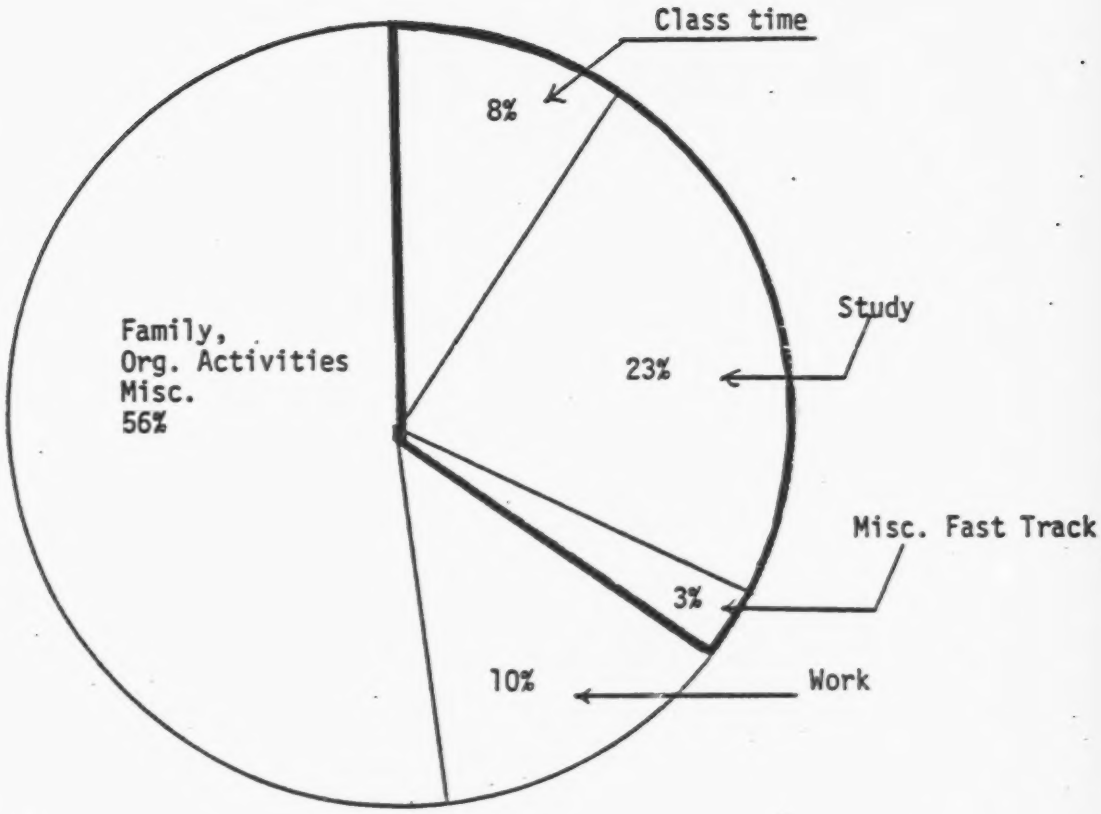
At the beginning of the program most participants worked hard because of the combined academic load of math and the engineering courses and because of the stress of a new experience in a different field. In Figure 4.1 is illustrated an approximate distribution of the waking hours of the "typical" Fast Track student. This information was gathered in April. It is possible that as the year went on the distribution varied somewhat. Typically the student spent about one-third the time in Fast Track activity, plus an additional ten percent in work. Those who did not work most often spent additional time studying or taking an extra class.

Actual comparisons were made on a number of factors which could assist or hinder a person's progress in the program. Though the data was gathered three times, only the first and final are reported in the following figures for the chemical and electrical tracks.

Figure 4.2 shows that the primary concerns for the participants were in the area of finances, child care and family

Figure 4.1

TIME DISTRIBUTION: FAST TRACK STUDENTS



problems. Finances and family problems did improve during the year. Two items moved downward during the year, spouse support and staff relations. The profiles of the individual tracks are quite alike except for the "re-entry into college" category. Here the chemical people had a much less positive attitude than did the electrical people.

On the final questionnaire there were other questions which gave an indication of change. Of the 26 persons surveyed, 18 indicated confidence in their ability to function as engineers, 11 electrical and 7 chemical. On an eleven point scale (10=all, 0=none) progress toward their own personal goals was rated at 7.35 (electrical 7.24 and chemical 7.56). The preference for the solution of problems was somewhat divided. The data show

	Electrical	Chemical
a. Best solution, shortest time	4	6
b. Detailed solution, regardless of time	10	2
c. Would rather work with people	3	1

the greater proportion of chemical track persons to be oriented to the best solution given a restricted amount of time; the electricals seem to be more prone to choose great detail.

Finally when asked to indicate their perception of the entire year from 0 (very negative) to 10 (very positive) the group mean was 6.73 (electrical 7.12, chemical 6.00).

Conclusions

Of greatest concern through the year was the problem of finance, followed by child care and family concerns. Although improving through the year they continued to be of concern. Spouse support was quite high to begin with but fell as the year progressed.

CONCERNS EFFECTING PROGRAM PARTIPATION TOTAL FAST TRACK

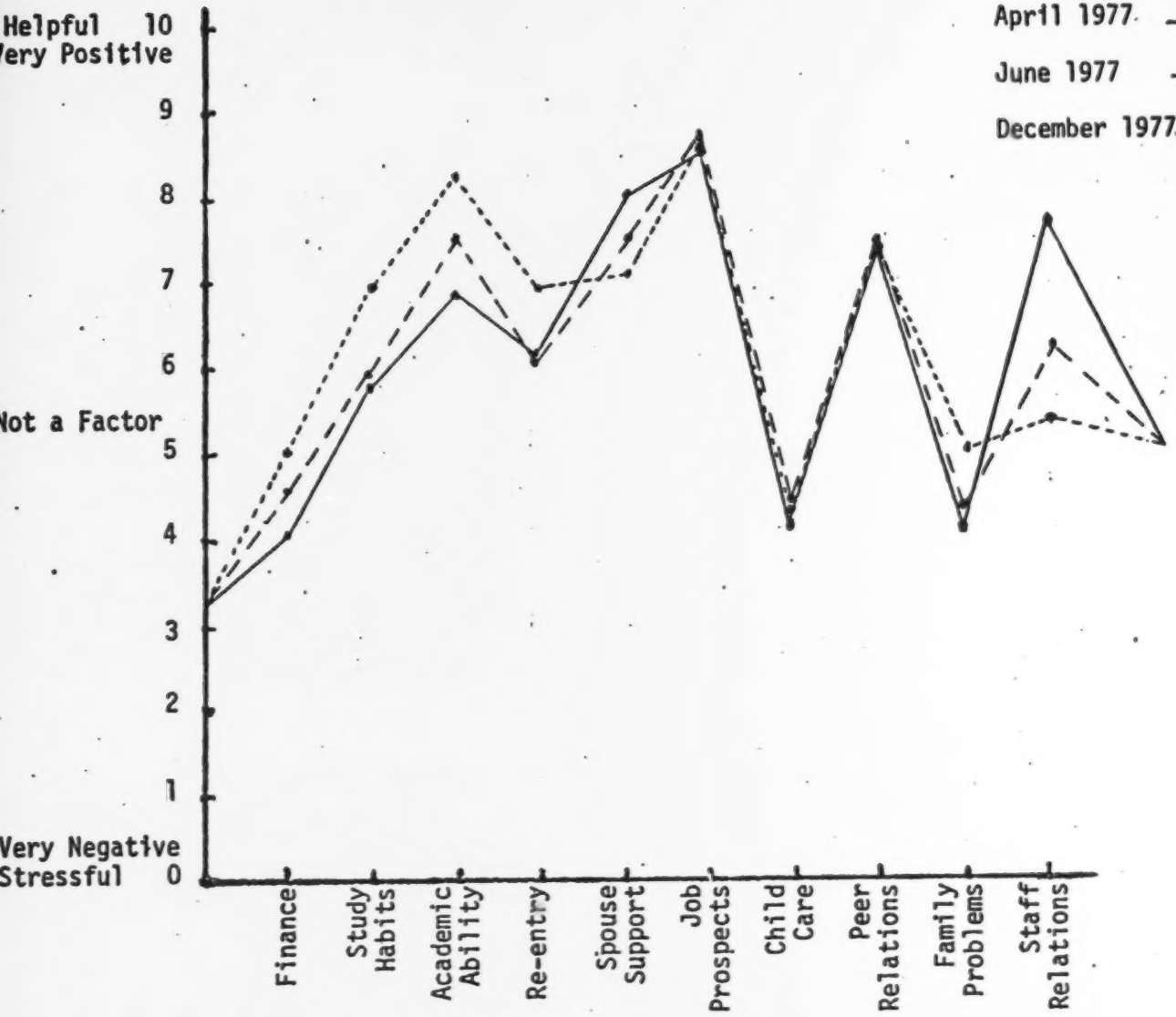
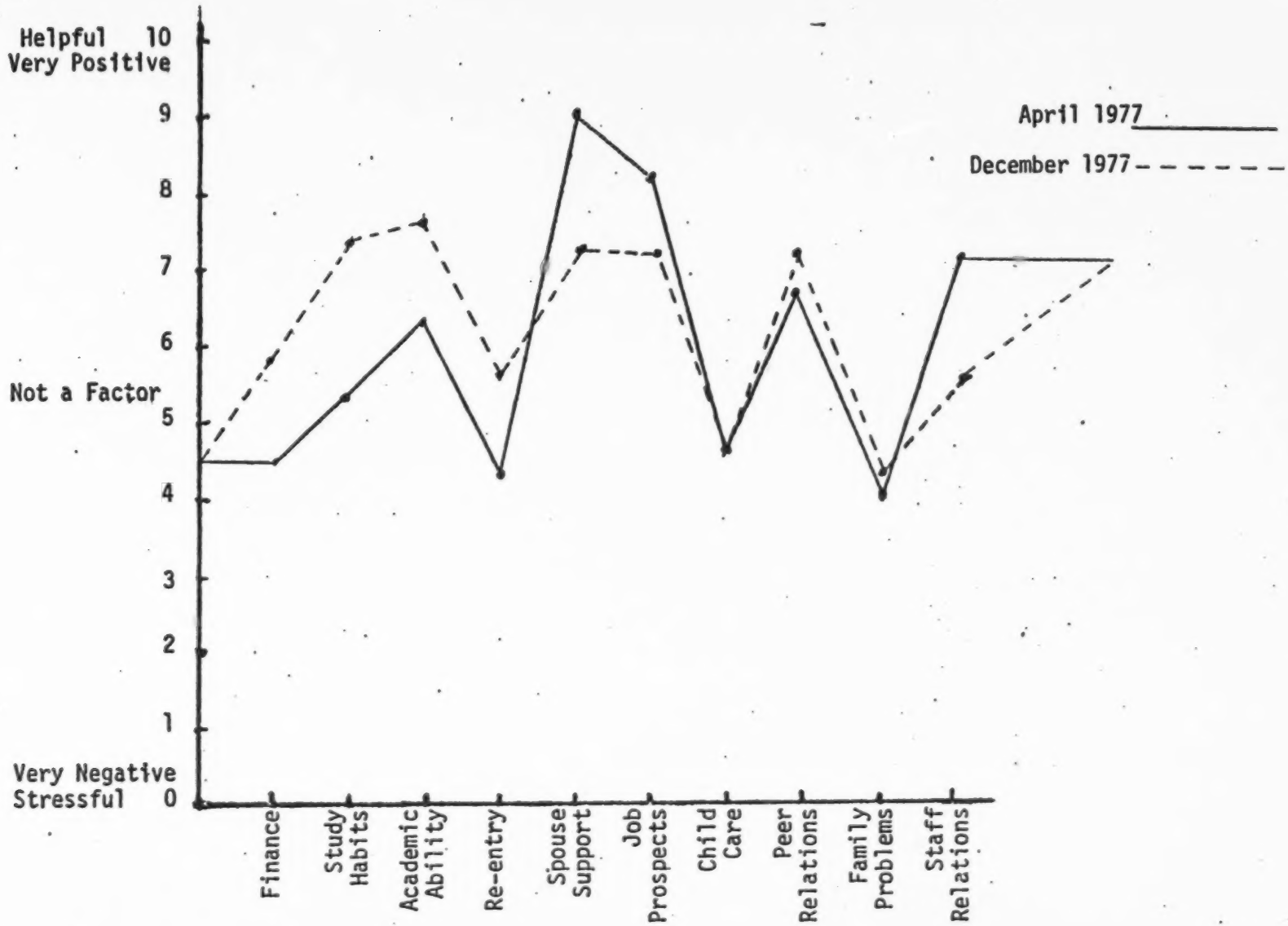
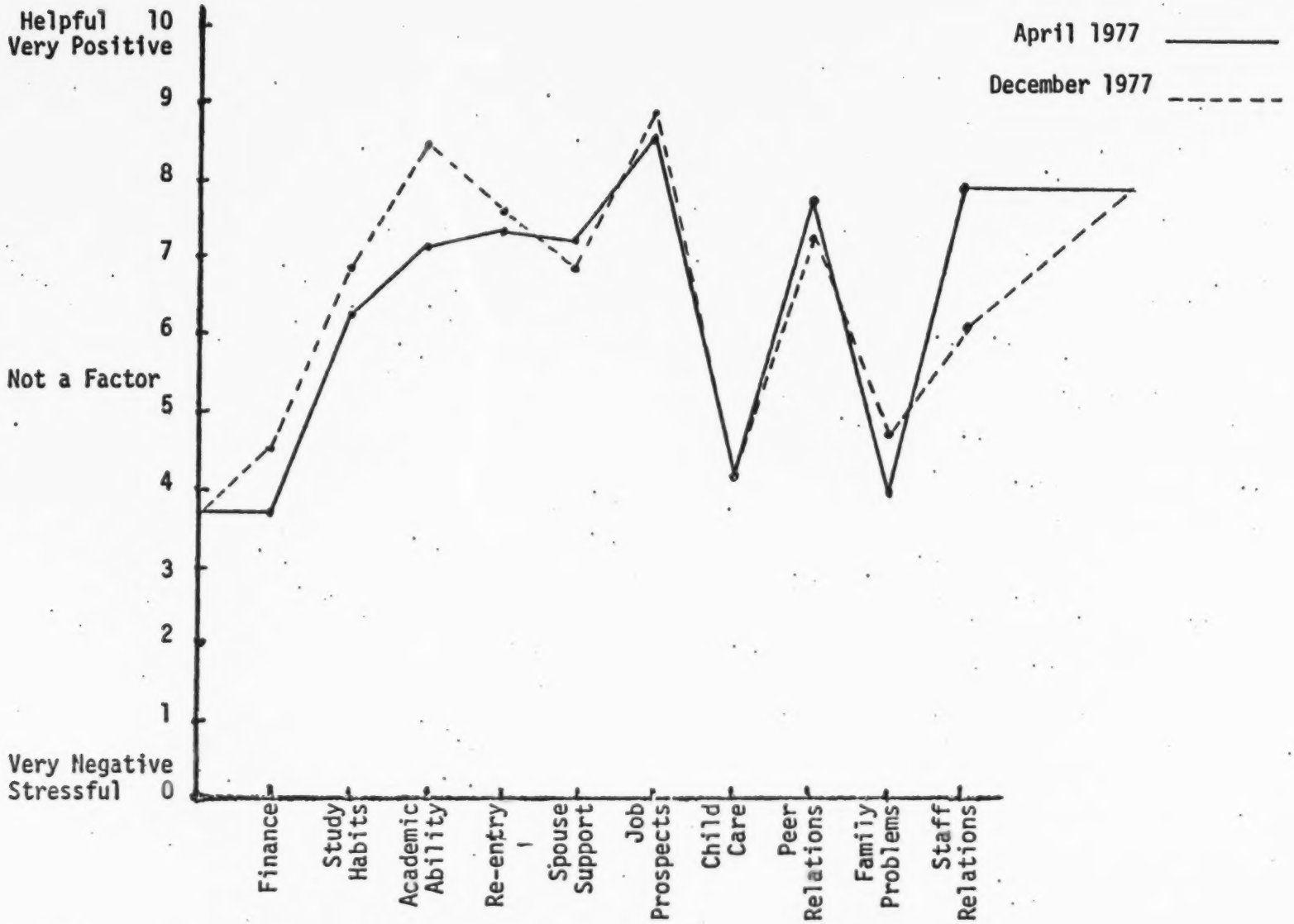


Figure 4.5

CONCERNS EFFECTING PROGRAM PARTICIPATION CHEMICAL TRACK



CONCERNS EFFECTING PROGRAM PARTICIPATION ELECTRICAL TRACK



Staff relations began high (7.75) but lost ground toward the end of the project (6.23). This was due primarily to the low rating given by the chemical students on the final survey.

	Chemical	Electrical
a. Interaction with Project Director	5.22	5.47
b. Interaction with Teachers	5.66	7.88

In addition, a comparison was made of those women who were married or divorced and those who were not married to determine if those factors relating to stress were different for these two groups. The following are the results for the two groups.

	Married (N=16)		Not Married (N=14)		Total	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
16. Stress Factor						
a. Financial Concerns	4.19	2.07	3.86	0.86	4.03	1.61
b. Study Habits	5.94	2.54	5.80	1.90	5.83	2.25
c. Personal Academic Ability	6.25	2.67	7.43	2.10	6.80	2.45
d. College Re-entry	5.31	2.27	6.93	2.43	6.06	2.45
e. Spouse Support	8.62	2.18	N.A.			
f. Future Job Prospects	8.12	2.25	8.79	1.85	8.43	2.06
g. Child Care	3.90	1.37	N.A.			
h. Peer Relations	7.46	2.18	7.31	2.18	7.36	2.11
i. Family Concerns	4.07	1.27	4.14	1.86	4.09	1.45
j. Interactions w/Staff	7.06	2.01	7.93	1.59	7.75	1.51

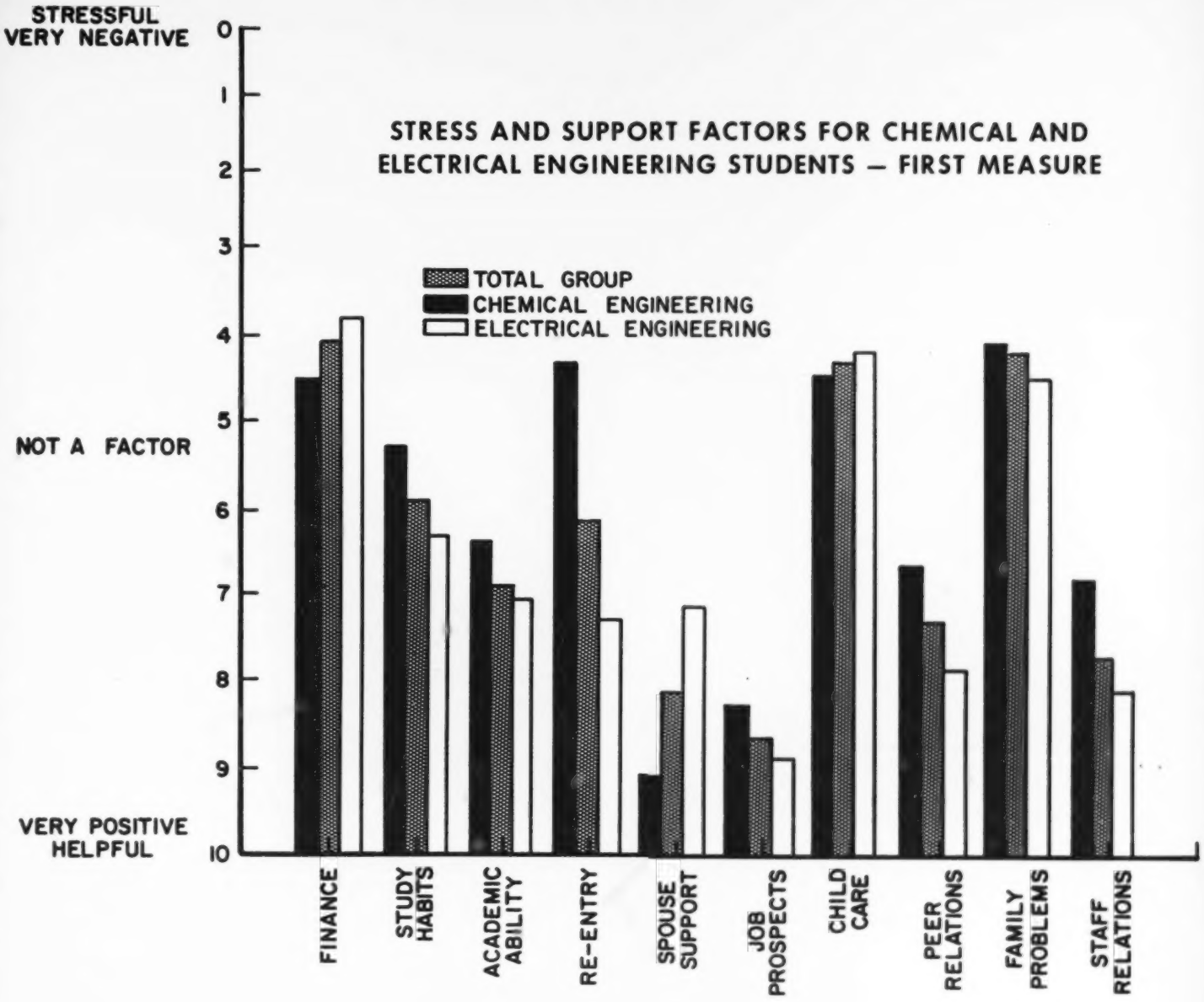
A review of the data shows that the same concerns present themselves, finance, child care and family. The only difference being that of child care which is a concern only of the married.

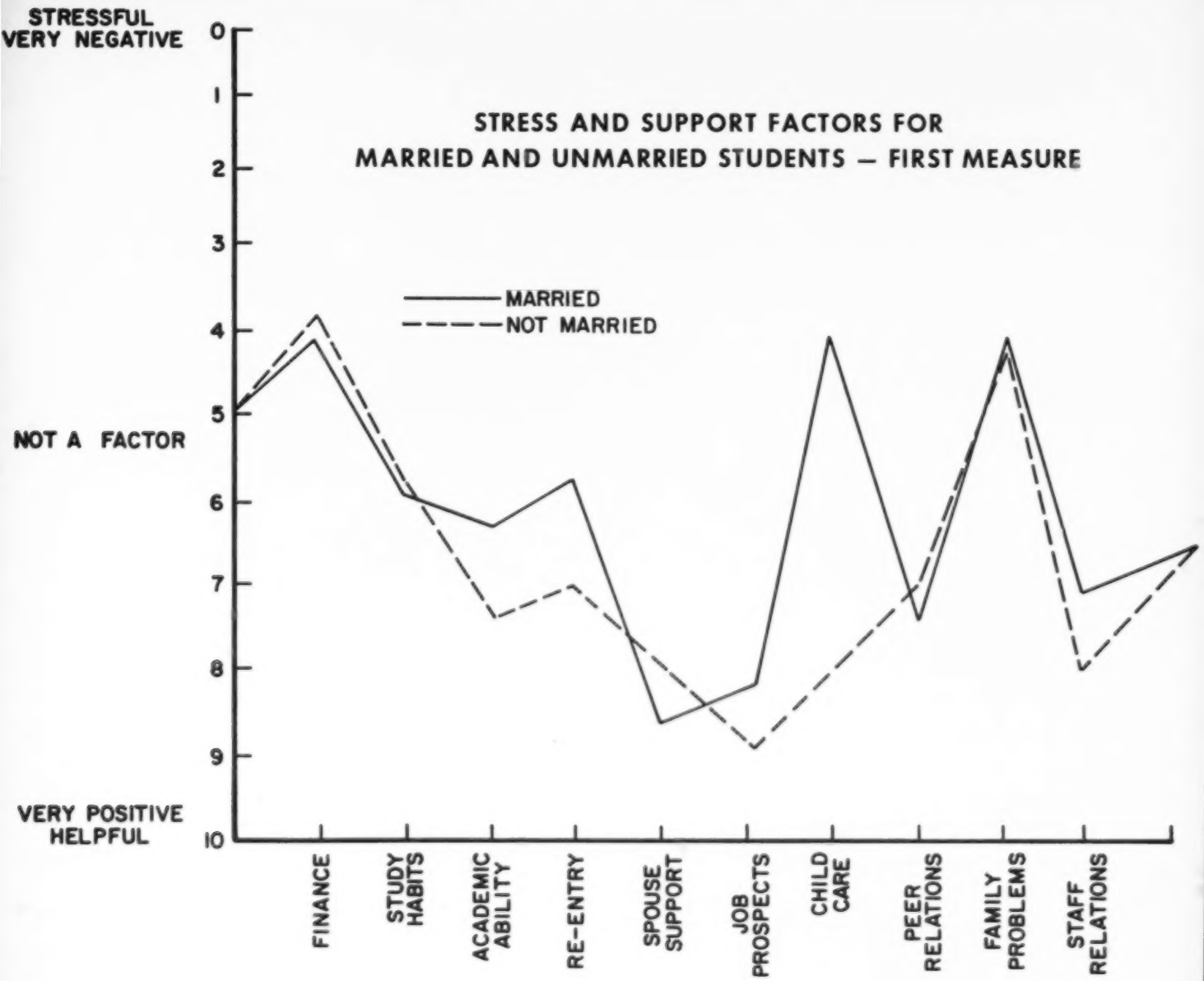
The differences between the two tracks (chemical and electrical) and also between the two groups (married and not married) for each of the stress factors are of significance only in two areas. (1) The electrical group felt significantly more positive (.05 level) about their reentry into the college scene. (2) Spouse support was more positive for the chemical group (.05 level). Both chemical and electrical groups, however, indicated positive spouse support.

Future job prospects proved to be the most positive overall factor. These data also show how similar the two tracks were in reporting positive and stress factors, but in general the electricals indicated a higher level of support on more factors than did the chemical group. This was also noted in the final evaluation. In the graph representing single and married students, the single students reported job prospects, peer relations and staff relations as more positive while married students reported spouse support, job prospects and peer relations as more positive. There is also a difference in perceived academic ability despite the difference in methodologies used. The married women felt a little less positive about their ability. However, we also need to examine whether or not this difference was due to age.

Interviews

One of the evaluation activities included as a part of the Fast-Track Project was an interview with each of the program participants. These interviews were conducted during the period of June 1 to June 9, 1977, at the mid-point of the program.


STRESSFUL
VERY NEGATIVE
0
1
2
3
4
5
NOT A FACTOR
6
7
8
9
VERY POSITIVE
HELPFUL
10
STRESS AND SUPPORT FACTORS FOR CHEMICAL AND
ELECTRICAL ENGINEERING STUDENTS — FIRST MEASURE
TOTAL GROUP
CHEMICAL ENGINEERING
ELECTRICAL ENGINEERING
FINANCE
STUDY HABITS
ACADEMIC ABILITY
RE-ENTRY
SPOUSE SUPPORT
JOB PROSPECTS
CHILD CARE
PEER RELATIONS
FAMILY PROBLEMS
STAFF RELATIONS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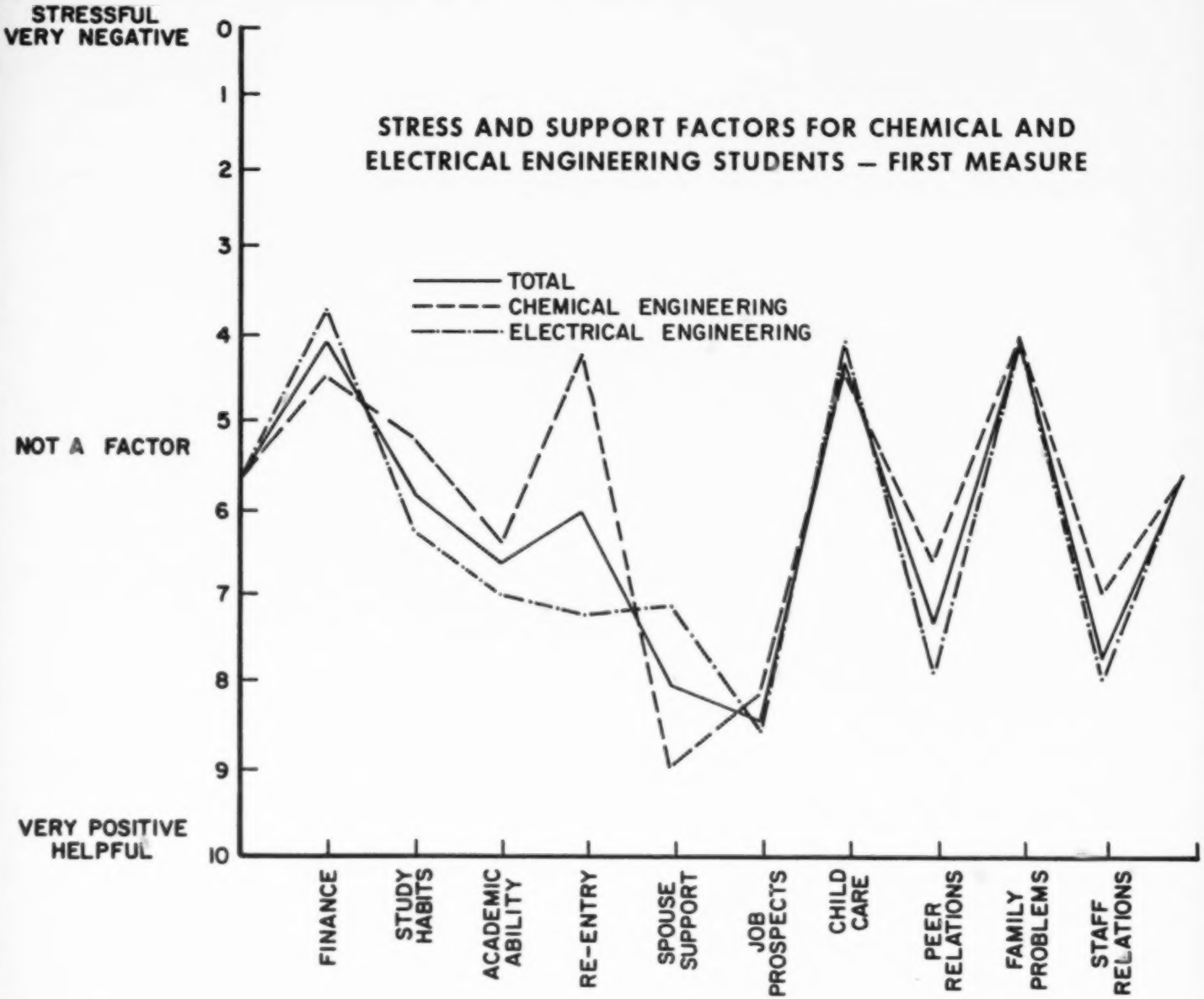
VERY POSITIVE
HELPFUL
10
STRESS AND SUPPORT FACTORS FOR
MARRIED AND UNMARRIED STUDENTS — FIRST MEASURE
MARRIED
NOT MARRIED
FINANCE
STUDY HABITS
ACADEMIC ABILITY
RE-ENTRY
SPOUSE SUPPORT
JOB PROSPECTS
CHILD CARE
PEER RELATIONS
FAMILY PROBLEMS
STAFF RELATIONS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VERY POSITIVE
HELPFUL
10
STRESS AND SUPPORT FACTORS FOR CHEMICAL AND
ELECTRICAL ENGINEERING STUDENTS – FIRST MEASURE
TOTAL
CHEMICAL ENGINEERING
ELECTRICAL ENGINEERING
FINANCE
STUDY HABITS
ACADEMIC ABILITY
RE-ENTRY
SPOUSE SUPPORT
JOB PROSPECTS
CHILD CARE
PEER RELATIONS
FAMILY PROBLEMS
STAFF RELATIONS

Each interview as allocated a period of 30 minutes which included a brief introduction of the interviewer, the reason for the interview and the assurance of confidentiality in order to obtain free and open conversation. This was followed by questions concerning the subject's college background and previous work, primarily to establish rapport and to break down the somewhat formal atmosphere which generally is present at the beginning of an interview. The following reasons were given for conducting the interviews.

1. They were indicated in the NSF proposal.
2. The data gathered could be used for change in the second half of the project.
3. In the event the project were repeated, the strong points would be emphasized and the weaknesses corrected. The primary data source for this information would be the project participant.

Subjects were asked to respond to seven questions prepared by the interviewer with the help of the project director and her assistant. At the close of the interview a period of time was given to free comments by the subject about any phase of the project.

Each person was asked to respond to the following.

1. What is your general overall impression of the project to date? Include administration, pre-entry problems, moving, housing, counseling, etc.
2. Are you satisfied with your personal progress to date? If "no," in what area and why.
3. Do you have any comments on the administration of the project. Have you had contact with the directors? If yes, were you satisfied with you contact?

4. Do you have any comments concerning those staff members who have been in charge of the courses which you have had to date, perceived competency, cooperation, empathy, etc.?

5. Have you any comments or criticisms concerning the surveys, questionnaires or interviews which have been a part of the evaluation activities? Do they take too much time? Are they clear and relatively simple? Do they seem meaningful?

6. Prior to entering the program how did you feel about what you were then doing? Had you thought about engineering as an alternative? Would you have moved into engineering without the benefit of the program? After nearly six months in this program do you view yourself more as an engineer than previously?

7. Given the diverse backgrounds of the various individuals in the program, do you have any comments on efforts or lack of effort to mold the group into a more homogeneous body both socially and/or academically?

8. Feel free to ask or comment on any topic concerning the project which has not been discussed.

Of the 28 women in the project, a total of 25 were interviewed, sixteen electrical and nine chemical. Three did not report.

Findings

1. There was almost total agreement on the efficiency of the general administration and organization of the project. Most commented that the schedule of events from the beginning of the Motivation Week through the present had been carefully planned. With respect to curriculum preparation, although the electrical and chemical courses were taught using different methodologies, both were thought to be extremely well developed.

While there were numerous negative comments on varied items, the interviewer felt that only one person was dissatisfied at being in the project. Several were lukewarm but all others were quite pleased to be in the program.

The most universal comment by individuals concerning the project was the unexpected speed with which the material was presented and covered. This was overwhelming to most. It was expected that the work would be difficult but they were unprepared for the speed with which course work commenced. It took considerable time to adjust to this, especially to become a "selective" learner.

Most students commented that they worked hard, but the amount varied considerably according to the interests and abilities of each person. Some were taking only the required load, some an extra course, and some were employed part time besides taking an extra course. All appeared to have adjusted to their own particular needs.

One common complaint conerned the problem of housing, a number one priority since many of the subjects had to relocate. They remarked that the help they received from University Housing was less than adequate. Housing problems were eventually solved, but not without some difficulties that the women felt might have been avoided. Most complained about being treated as "students" rather than part of a special program. The lack of awareness by the University of the special status of these persons contributed bo some negativism toward the program.

To a lesser degree, some pointed out the need for an orientation to the program especially in terms of what engineering is all about. A number of participants admitted they entered without any knowledge of the work of engineers or whether they

would even like it or had the necessary attributes leading toward a successful engineering career. (Two persons gave themselves the Kuder Inventory.)

2. Students were generally satisfied with their progress. Statements such as "pleased," "satisfied, but I could do better," "as well as expected," were most common. Only in one or two instances did respondents comment that their grades were less than what they had been as undergraduates. A common remark was the fact that after considerable graduate work getting used to the different grade structure of undergraduate programs was difficult.

Electrical persons commented on their preference for the self-paced course. Several commented on the one five-week term. Things had moved rapidly enough during the seven-week sessions but the five-week term was most difficult. It was even suggested using two weeks of the vacation time in order to stretch out the class time.

Several persons expressed a need for some sort of assurance that they were learning that which was needed and would be useful on the job. Two of these were in touch with practicing engineers who had given them this assurance.

3. Comments about the project director and her assistant were varied. All of the women were positive in their comments concerning before or beginning project assistance. The help in finding employment was appreciated. On the other hand, there had been little contact with the director after the first few weeks of the projects other than the called meetings because there was no need.

4. - The evaluation procedures received little comment. Most said they realized that evaluation was a part of any project and accepted this. Only one person questioned the anonymity of the questionnaires since so much information was requested.

5. Discussion of participants' backgrounds brought varied responses. A few had been in degree related work. Several had been unemployed. Others had been in work related to their training. Most, however, had been underemployed or in work unrelated to their training. As a group they were not happy in their work or felt "boxed in" with little possibility of upward movement. In almost every case each person had been looking for something else or had made serious inquiries for additional work at some college or university.

Almost without exception there was agreement that without the help of this project:

a. they would not have entered into the field of engineering, and/or

b. they would not have been able, financially, to either go back to school, and/or

c. they would not have made the transition to engineering because, on a part-time basis, the length of time needed to complete the work was just too long.

Whether or not the participants viewed themselves as engineers was difficult to assess. Some had previous experience with engineering but most had no previous conception of what engineering was about. The most common answer was "not yet not I think I am getting there." Some stated that earlier more practical, hands-on or laboratory experiences would help affect this mental change.

6. Not a great deal of comment was forthcoming on the question of out-of-class social activities of efforts to have group activities. Most persons felt they had adjusted and developed a program to suit their own needs. Quite a few visited each weekend to family and friends. Others brought their families along.

The few attempts that were made to have social activities were not viewed as successful and were generally described as dull. The most successful activities were in physical education organized by some of the participants.

It was suggested by some that a valuable help to the participants would be an informational service listing places to go, things to see, (plays, museums and similar activities) in Dayton.

7. Most of the final comments reiterated the fact that they were happy to be a part of the program and were grateful for the help they were receiving.

Foremost, among the comments at this point concerned the self-generated pressure to receive top grades. They were quick to point out that this was self imposed and not staff generated, but they were also at loss as to how it could be eliminated. They felt it led to panic at test time and real tension among the participants, especially those in the chemical track. Some thought it might be due to the fact that most all were used to top grades and could not reconcile themselves to being anything but the best. This led at times to lack of cooperation among some students.

It was suggested, especially in the elctrical track, that an earlier movement toward laboratory experiences would be helpful in going from theory to practice. The access to a laboratory for volunteer participation and explanation was suggested. Some felt their work experience at DESC was not what they were led to expect, that is, engineering related. Beyond the classroom, of greatest concern was the need to have adequate financial support.

Conclusions

While there were areas of criticism about various aspects of the program, the participants as a group felt positive in their participation and were happy to be in the program.

There were some spots of tension, frustration and general unhappiness remaining for individual women in the program, but most were individual in nature. The concerns which centered on before or beginning project activities can be eliminated if and when the project is used again.

Curriculum

Introduction

No matter the amount of planning and curriculum development which takes place prior to the actual administration of the project, only as the project moves through its planned course that can one actually assess the results of the planning. The prior experience of the Monsanto project was of great help to the staff of the Chemistry Track. The Electrical Track was equally fortunate in having students which an extremely high proficiency in math.

Findings

A survey of the faculty revealed few changes in curriculum during the course of the project. Those that were made benefitted the participants and made the program stronger. CME 306 was expanded from two hours to three hours credit in order to cover more material. Because of the math proficiency of the students a course in special problems in engineering electromagnetics was made available (ELE499). A full discussion of curriculum can be found in Chapter II.

Concern over what engineering is and what engineers do initiated a program of visiting engineers to the campus. Additional concern over future job prospects led to the development of the Career Education course the discussion of which will be found in Chapter III.

For the rest of the courses, any adjustments made were no different than those generally made when one teaches a class and adjusts materials, methods and context to suit the individual class. The survey of the faculty is best summed up by the following quote. "...the classroom situation, materials, texts, and method of teaching, were virtually the same as for the regular sequence. Naturally, there were some personal differences, But the adjustments were no different than those encountered from one class to another."

Conclusions

The curriculum for the program was well planned and developed. The faculty and directors were also aware of additional need and made adjustments or additions accordingly.

Academic Performance

Introduction

An assessment of academic acheivement was made during the program by comparing the Fast Track students with students in the regular engineering program. With the exception of the final exam these tests were not specifically constructed for this purpose but were those which were used as a normal part of the course. It was felt that because of their motivation for being in the program the Fast Track students would achieve higher. Since all groups were taken "as is" with no assumptions of normality of the population, a non-parametric statistic was used to test the directional hypothesis. The Mann-Whitney U Test (Siegel; pp 116-127) because of its flexibility for use with both small and large groups and its power for use with ordinal data was selected as the statistic where comparisons were made.

Tables 4.2 through 4.6 show common examinations given to the indicated groups but which were taught in separate courses. In Table 4.7 the Fast Track students were a part of the regular class in Field Theory. Table 4.8 shows the results of a common final examiniation given to Fast Track participants in the electrical track and their senior counterparts in the school of engineering.

Findings

The data on Tables 4.2 through 4.7 show that the hypothesis of higher achievement was substantiated in six of the ten comparisons at the .05 level of confidence. In three of the four

instances where significance could not be substantiated the mean for the Fast Track students was higher than the other.

In Table 4.8 the data show the number of correct answers for each problem by group, and by percent of the group. The Fast Track students had a higher percent of persons giving correct answers on seven of the problems while their senior counterparts were higher on three.

Conclusions

A review of the data show the Fast Track participants to be a high achieving group, higher than the Monsanto and the regular engineering students.

TABLE 4.2

CME 452 EXAM I COMPARISONS

A. Fast Track	B. 4-Year Students	C. Monsanto
67	58 68	42
58	68 71	52
52	68 60	21
75	44 22	71
86	44 51	84
58	47 33	50
68	52 36	40
60	61 48	45
	63 43	
	64	
Range=52-86	Range=22-71	Range=21-84
$\bar{x}$ =65.5	$\bar{x}$ =52.68	$\bar{x}$ =50.62
sd =10.98	sd =13.61	sd =19.38

A and B U = 13.5 z = 1.94 $p < .05$

A and C U = 40.5 z = 1.88 $p < .05$

TABLE 4.3

CME 452 EXAM II COMPARISONS

A. Fast Track	B. 4-Year Students	C. Monsanto
87	93 97	77
66	65 87	62
97	84 91	44
90	83 46	95
87	73 57	80
61	82 91	50
90	97 54	81
89	95 42	80
	99 47	
	90	
Range=61-97	Range=42-99	Range=44-95
$\bar{x}$ =83.38	$\bar{x}$ =77.57	$\bar{x}$ =71.12
sd =12.73	sd =19.44	sd =17.42

A and B U = 15 z = 1.73 $p < .05$

A and C U = 70 z = .32 $p > .05$

TABLE 4.4

CME 452 EXAM 3 COMPARISON

A. Fast Track	B. 4-Year Student	C. Monsanto
69	80 45	75
66	18 56	89
51	85 22	68
61	43 90	69
92	58 90	87
86	79 86	25
38	69 69	37
75	75 91	67
	36 72	
	94	
Range=38-92	Range=18-94	Range=25.89
$\bar{x}$ =67.25	$\bar{x}$ =66.21	$\bar{x}$ =64.63
sd =17.68	sd =23.68	sd =22.59

A and B U = 32 z = 0.0 p > .05

A and C U = 85 z = .75 p > .05

SECTION 12

EVALUATION INTERVIEWS - FAST TRACK II

Introduction

The overall evaluation of Fast Track II was not as extensive as Fast Track I because we had benefitted from the formative data and had made appropriate program modifications. However, we did feel it was appropriate to interview the students at the beginning and end of the overall program. The following reports conducted by the Office of Educational Services summarized those reports.

EVALUATION REPORT
FAST TRACK II

INTERVIEWS

Presented to

Professor Carol Shaw
Project Director

by

Dr. Herman Torge
Mrs. Ellen Faust

Office of Educational Services
University of Dayton
Dayton, Ohio 45469

June 6, 1979

FAST TRACK II
WOMEN IN ENGINEERING

REPORT OF INTERVIEWS

INTRODUCTION

The interviews with Fast Track II participants were included as part of the evaluation activities of the program. Interviews were an important and valuable segment of the Fast Track I evaluation. Consequently, this activity was planned for the second funding of the program.

Whereas, interviews were conducted only at the mid-point of Fast Track I, this cycle has two interviews scheduled, the present one and a terminal interview in early December 1979.

A schedule for interviews with all participants was prepared for the period of May 7 through May 16, 1979. Because of the greater number to be interviewed, two interviewers were used, one male and one female. Subjects were assigned so that each interviewer had a like number from the chemical and electrical tracks.

Each session was allocated an amount of 30 minutes with no more than four sessions scheduled consecutively. Each interviewer was given a set of topics to be covered during the allotted time, but was given the freedom to pursue these in any order as the situation warranted. Attempts were made to establish an informal setting in order that respondents would feel free to converse openly.

Prior to conducting the sessions a brief biographical chart of those to be interviewed was compiled. This included data available from the application forms on file in the project office on the person's education, residence and work history.

The general format of each interview included a brief introduction by the interviewer including the reasons for the session and the assurance of confidentiality. This was followed by a brief probing into additional information concerning the subject's education background and work history. In this manner, the somewhat formal atmostphere which is usually present at the beginning of an interview was broken down.

The following reasons were given as to the interview:

1. It was a necessary part of the evaluation in order to have face-to-face reaction from the participants.
2. The information received could be used to change weak areas of the program and to capitalize on the areas of strength.
3. By repeating the interviews one can compare reactions from Fast Track I with those of Fast Track II.

During the remainder of the interview, respondents were asked for their reactions to the following which were developed with the assistance of the project director and her assistant. Similar questions were asked during Fast Track I interviews.

1. What kind of work were you doing prior to entry into this program? Was it degree related? What about salary, job satisfaction, and advancement opportunities? Why did you leave to enter this program? Do you have a career goal? Why did you apply to Fast Track II?
2. Did you experience any difficulties coming on campus in terms of housing or moving? Did you get the information you needed from those in charge?

3. Financial implications: Are you receiving financial assistance? Student loan? Working? What is your present financial situation?
4. Do you have any comments about the main parts of the program as represented by Dean Shaw, Mrs. Cherry and counseling services? Have you had contact with any of these? Did you feel you were well received and given the help you needed?
5. How would you rate the academic program? The teaching methodology? The teaching staff?
6. Is the Fast Track program what you expected it to be? Did you have a concept of what engineering was before you entered the program? If not, do you now?
7. How satisfied are you with your progress to date? If you are not why and what do you plan to do to improve?
8. Finally, respondents were asked to make any other comments they might wish to make about the Fast Track II program.

A total of 38 persons were interviewed comprising the total enrollment of Fast Track II.

FINDINGS

The following represents a summary of the comments made by the individual interviewed.

Question 1:

Those interviewed had been engaged in a wide variety of vocational endeavors ranging from research activities and engineering assistant to custodial employee. Several persons were not currently employed, but were either homemakers or between jobs. Two vocations were strongly represented. Ten persons were engaged in teaching with three additional in education

related jobs. Ten persons were engaged in research activities.

Numerous reasons were given as to why they wanted to leave their jobs.

1. The job, while having an occasional challenge, was, for the greater part, boring.
2. The work was not what they wanted. Blame was placed on the lack of guidance in high school and college, which did not provide sufficient emphasis on opportunities for women in male dominated careers.
3. Low salary was given as a reason.
4. There was no opportunity for advancement because of the lack of an advanced degree, sexism, and/or the nature of the work.
5. The job was not degree related or did not require of them the expertise they felt they had.

In many cases, those interviewed indicated that they had good jobs but felt the need to change into a position or field that presented more of a challenge.

Fast Track came at a very opportune time for most. It was a time when they had already made a decision to seek other work or to return to school to seek additional training. The compactness of the program, (retraining in a space of one year) was especially attractive.

Career goal indications varied. Some were fairly definite as to where they wished to go while others were not nearly so certain. Because some had little knowledge of the scope of the engineering profession they had not been able to set their sights on anything other than "engineering". Others indicated such a goal as "engineering management." All, however, were certain they wanted a profession that was challenging and of interest. This they believed engineering would provide.

Question 2:

Moving into the program seemed to present few problems to the Fast Track participants. A previous evaluation of the Motivational-Diagnostic Week showed the value of that activity. Nevertheless, it was again mentioned as a very important time. Two of those interviewed said that they had previously rated the Week as not very helpful but now believed it to have been very necessary.

Respondents indicated that when help was needed it was forthcoming from project administrators, staff, secretaries and other university persons. Housing was not mentioned as a problem. Evidently the housing at Miami Valley is satisfactory.

For whatever reason several persons indicated that the time between acceptance and program start was too short. There was very little time to set affairs in order and move to the Dayton area.

Three persons commented on the heavy emphasis placed on dollar oriented success rather than personal goals orientation. This emphasis seemed contrary to the goal of career success and personal satisfactions.

Question 3:

The problem of financial support seemed to be much less intense than with the previous group of Fast Trackers. This can be attributed to at least two reasons. One, the allotments made available from project funds to qualified persons. Second, more resources personally available by way of savings, spouse or family support and loans.

One new development in the program was the available of project funds for financial assistance. The project administration with the Office of Financial Assistance developed a formula by which funds were allotted to

those who applied and qualified. The amounts ranged from $150 to $1,350 and included 27 persons. An amount was also set aside for emergency purposes. To date 4 of these grants have been given at the discretion of the project director. These ranged from $125 to $250.

There was no indication of dissatisfaction concerning these financial grants or the method by which they were given. It is true that several indicated they could have used more, but it was understood that the amount was limited. The women were all appreciative of this assistance.

Aside from the aid through project funds, financial support necessary to exist for the life of the project came from the following sources depending upon the individual.

-Savings

-Spouse or family

-Working part time (usually WPAFB)

-Student loans

-Careful budgeting

The single item of expense that presented the biggest problem to several persons was the matter of tuition for the courses fulfilling the philosophy requirement for graduation. Though not a part of the Fast Track program those involved felt it necessary to work toward a degree in engineering, thus the problem.

When an unforeseen circumstance arose, those involved indicated that the project director had been of assistance and very cooperative.

All were optomistic about making it through the year.

Question 4:

Outside of the classroom or academic areas, three sources of help have been available to participants; Dean Carol Shaw for concerns of a general nature and financial problems; Mrs. Nancy Cherry for areas concerning professional development; and University Counseling Services for personal problems.

Not all women had found it necessary to seek assistance or advice. Those who have reported that they were well received and indicated they had been helped. Dean Shaw was described as cooperative, understanding and, though "very busy", able to give assistance. Mrs. Cherry was positive in her attitude toward people and very helpful. Few people had sought assistance from counseling but, with the exception of a broken appointment, found them to be helpful.

One other person mentioned often as being very helpful was Mrs. Vivian Pignatiello, secretary to Dean Shaw. Evidently many items are handled by her much to the satisfaction of the students.

Question 5:

A part of the interview was given to soliciting opinions concerning the academic area of the Fast Track program. The women were asked to comment on organization, methodology, staff, and their over all perception of their class time. Because of the large proportion of teachers in this cycle of the program, comments at times tended to be rather critical. Content of the courses was not criticized but methodology and staff were.

Those who were involved in the opening courses in mathematics spoke highly of the courses and those who taught it. It was felt to be very helpful, especially since quite a few had not used their math training for

sometime. Comments about the instructors indicated that they were very helpful, willing to take extra time and displayed a keen interest in the students.

Those in the electrical track also were positive about their courses and the instructors. The self-paced courses were received quite positively. Participants commented on the fact that they were able to pace themselves at the beginning of the program when adjustment was most difficult. A few indicated that they had moved a little too slowly and were now paying by having to catch up because of the sequentiality of the material. The electrical staff received positive comments.

Those in the chemical track tended to be rather negative about the instructors they had in the early chemical engineering courses. From these persons came comments about the lack of course outline, lack of course or class objectives, and lack of a syllabus or any other type of benchmarks to which they could orient themselves.

These persons indicated that, to them, being a good teacher was more important than research activities. Also cited were lack of rapport and understanding. Of the three persons they had as instructors in the chemical track (not including math) the first received much criticism, the second was given very positive comments and the third was looked on negatively but opinions were not yet certain because of the short period of time involved.

Comments about the Professional Development course are included in a separate report.

Question 6:

Participants indicated the program is all they expected it would be, and more. With only two or three exceptions, all indicated they were working as hard as they ever had and that the pace was quite rapid. Yet there was understanding that this was necessary in order to complete the requirements within a span of one year.

There was no indication that they would trade off a slower pace with a longer period of time. They have adjusted to this accelerated pace and look forward to finishing by December.

The concept of what engineering is about is much more prevalent with this group. It was present more from the beginning and most now look at themselves as in the process of becoming engineers with an understanding of the profession.

Question 7:

All were asked to make a self-assessment of their progress to date. There was some indication that they could do better but the opinion was that they were personally satisfied with their progress. Concern for grades seemed to be minimal. The greater concern was for getting the right content to do the job when the program is over. A number of times the respondent would make a comment to the effect that"I set certain goals for myself and am in the process of accomplishing them."

General comments:

The remark made most frequently by those interviewed was that "even if it were not free, I would want to be a part of this program. Somehow I would find the money to participate."

There were 38 persons interviewed and in the opinions of the two interviewers, only 3 seemed to have a somewhat negative attitude. Yet even in these persons there was no indication that they had made a poor choice in coming into the program. Students were pleased to be a part of Fast Track II and the opportunity it provides.

CONCLUSIONS

A comparison of this set of interviews with those given at a similar time in Fast Track I indicates a considerable difference.

1. Entry into the program by participants was much smoother. Housing problems seemed to be virtually non-existent this time.
2. Pre-program entry jobs of participants were much better than those of the previous Fast Track. Salaries received were also at a higher level.
3. The antagonism and stress coming out of the mathematics course in Fast Track I was completely gone.
4. The use of some money for minimal financial support has had a positive effect on participants. While finance is still a problem for a few, the rest are having little or no difficulty.
5. The part-time work at WPAFB is helpful and seems to be oriented to engineering.
6. There is virtually no dissatisfaction with those in charge of the project. In fact, positive comments were freely given.
7. On the whole participants seem much more satisfied, better adjusted and much happier than those of the previous program.

8. In only one area is there a common thread in the two programs. The dissatisfaction with the early courses in the Chemical Track is still there. It does not seem to have improved.

The interviewers would conclude from the data gathered that from the participants point of view Fast Track II is much improved over Fast Track I.

Fast Track II: Evaluation Report
Second Interviews

Introduction

Second interviews with the participants of Fast Track II were conducted November 13-15, 1979. This time seemed appropriate for soliciting year-end perceptions of the program. The Job Fair was behind them, job offers were being received, final exams were yet a few weeks away and the program was about over.

A total of twenty-nine participants were interviewed, all of whom had previously interviewed in May, 1979. Six persons were not interviewed because of work conflicts. The questions posed to those interviewed were basically a repeat of those asked during the first interview. Some, however, were additions because of the nature of the program. Interviews were conducted during a twenty minute period. Two persons, a male and a female, interviewed the participants who were randomly assigned.

The following questions were asked during the interview:

1. What is your general impression of the following facets of the program:
   a. The administration and administrators;
   b. The courses, staff and general teaching quality;
   c. Your preference for the self-paced versus the lecture type courses;
   d. Classes with regular university students as opposed to Fast Track segregated courses;
   e. Your evaluation of the Professional Development Course.
2. Do you have financial concerns? Are they more or less than at this time last May?

3. Are you satisfied with your progress toward the goal of being an engineer?
4. How do you feel you compare with the regular undergraduate engineering students? Has there been a change in your work-study pattern?
5. Will you complete your degree by the end of the program? If not, do you plan to finish and when?
6. What are your job expectations?
7. Do you have any general comments for the improvement of the program?

Findings

1. a. Very positive comments were made on the general administration of the project. Everything was well organized and those persons in charge were available if needed. Negatively, the only comment referred to the director. Several students wished they could have learned to know her better because they admired her.

1. b. Comments on courses and staff categorize themselves by track. The chemistry track was extremely negative in their comments about the teaching ability of the staff. Most felt that they had to find out everything for themselves without any assistance. Poor organization was also cited. As a result, a number of the chemical track students felt threatened and were very anxious about the last weeks of the program. Contrary, the electrical track students had little but praise for their courses and the staff. The only exception seemed to be the electronics course. Several persons felt that they would have to take that again and were not looking for positions involving that type of work.

1. c. Since only the electrical track had self-paced courses, they were asked to compare this with the more conventional lecture type. There was not a preference for either given. It was stated that the self-paced work came at a time early in the program and thus allowed the students to adjust class work on a need basis. Some students are just now finishing their self-paced work in order to force earlier completion.

1. d. Participation in classes with regular undergraduate engineering students seemed to be no problem. Most stated that it was the undergraduate that was at a disadvantage. It was also commented that this arrangement was an advantage at interviews. It could be shown to prospective employers that Fast Track course work was not watered down but was of the same quality as the regular engineering program.

1. e. Reactions to the Professional Development Course tended to be extreme with little middle ground. It was either "a waste of time" or "very helpful." Those who found that it helped cited the units on resumé writing and interviewing. Those who did not like it felt that it was a "one month course expanded to a year". It was mentioned several times that a workshop might have accomplished more.

2. Financial problems, though present, seemed to be of little consequence at this time. Those who needed money had either obtained part-time work, if they could handle it, or they had secured loans. The rest had savings, spouses or other means upon which they could rely.

3. There was little doubt in the minds of the participants that they had made considerable progress during the year. A few doubted that they were well-qualified as engineers after such a short period of time. They nevertheless felt that some on-the-job experience would selve this problem. All voiced the opinion that they were above the regular student as a saleable product.

4. Changes in study habits came early in the program. The support groups have given way to study groups of the students' own design. It was mentioned often that study groups are a necessity for survival. The great amount of work involved in the program calls for mutual efforts, support and a division of the labor in order that all the work can be completed. The use of study groups probably was a major factor in some students remaining in the program.

5. Of the twenty-nine persons interviewed, twenty-two will receive a degree in engineering at the end of the program. All others intend to have the degree by April or June of 1980 by completing the philosophy requirement. One student will probably graduate later due to the lack of several science courses.

6. The situation concerning future employment was unclear at the time of the interviews. Not all students took part in the Job Fair. Those who did not had specific locations or companies in mind and determined to go ahead on their own. They seemed to be meeting with reasonable success. Those who took part in the Job Fair have had numerous interviews and are in the process of second interviews and plant tours. Few final commitments have been made. Most persons have placed certain limitations upon "what" and "where", thus prolonging the job hunting process. Some stated they will seek jobs more seriously after the term is over. The comment was made several times, especially by the chemical track people, that seeking work during this term was almost impossible in light of the great amount of class work that needed to be done. Loss of class time simply could not be afforded. Electrical track students appear to have a better job market. A number of electricals have received more than one firm job offer. Chemical students, actively seeking jobs, have not met with the same success.

7. Most general comments at the end referred back to comments made earlier. Several others bear mentioning.

a. The electrical track were in agreement that assistance in the laboratory would have been very helpful. Many persons were not acquainted with the equipment and lost much time finding out how to set up and operate it.

b. A suggestion was made several times that a course in microprocessors would be of help.

c. It was suggested that earlier mention be made of the need to have the philosophy courses as a requirement for the degree.

d. Some persons suggested that faculty make more effort to become better acquainted with the students (communication). Along the same line, some would have like to become better acquainted on a more informal basis with the project administrator because of the admiration they have for her.

On the whole, participants were satisfied with the progress of the year and said it was a good program. Some reservations were expressed by the chemical track because of their perception of staff teaching ability. This was not so for the electrical.

Conclusion

In spite of some complaints and criticisms, the program was satisfactory to those taking part. There was very little difference in the opinions expressed during the second interview as compared to the first. The chemical persons were the most negative, the electrical were quite positive. Some improvement in attitude toward the Professional Development Course was evident because of the inclusion of several topics perceived to be more relevant.

SECTION 13

SUMMARY, CONCLUSION AND RECOMMENDATIONS

The University of Dayton Career Facilitation Program, Fast Track, accomplished its goal of bringing women with Bachelor's degrees in math, chemistry, and physics to a technical level in Chemical or Electrical Engineering equivalent to Bachelor's degree recipients. We accomplished this with an excellent retention rate (89 percent).

The Fast Track program also achieved its goal of obtaining employment in the engineering workforce for its graduates. Ninety-six percent of the Fast Track graduates were placed in engineering positions, many with Fortune 500 companies. Salaries ranged from $14,000 to $26,000 for the two program offerings. The program demonstrated that a wide variety of curricular approaches could be used and that adult women who had been out of the educational system for 2-15 years and who were under or unemployed in terms of their previous degree could successfully enter and complete a career change program from science to engineering.

Participants were recruited nationwide by asking interested colleges and universities to supply their alumni mailing lists.

In reviewing the typical University of Dayton reentry applicant, we found that 60 percent indicated they were underutilized or underemployed in terms of their previous degree. Thirty percent of all the Fast Track applicants in both programs already had Master's degrees.

The Fast Track faculty had originally proposed a 26 hour curriculum to the National Science Foundation (NSF), but after evaluation of the backgrounds of the participants, increased that to 30 and then to 36-39 hours.

We feel that 36-39 hours constitutes a rigorous, but feasible full-time 12-month reentry program.

The most successful curricular approach to the reentry program in engineering appears to be a transitional beginning using self-paced or some other approach which focuses on individualized needs yet provides for dealing with reentry students as a unit. Integration into regular undergraduate courses later in the program is also a successful strategy because it builds self-confidence that the students can compete at the level of regular undergraduate or graduate students.

Factors students rated as positive in relation to their participation in the program were: improved employment opportunities; spouse support; project staff and faculty; and, their academic ability. Factors that participants rated as negative or stress-producing were: financial and family concerns; fear of reentry or perceived inability to complete the program; peer relations; competition; teaching styles; and, the workload. In both Fast Track I and Fast Track II, financial considerations were important because 70 percent of the participants relocated to attend the program We, therefore, had to concern ourselves with finding financial support for the women to facilitate paying for housing and other living expenses. The students overall evaluation of the program related more to whether or not they liked the teaching methodology used and the amount of rigor and stress they felt in the program rather than to an abstract measure of program success like placement.

Placement efforts for the Fast Track program were extremely successful. We utilized a Job Fair, normal University placement procedures, and self-placement. Most students in the Fast Track program interviewed between

5 and 10 companies and received numerous job offers. We considered the Professional Development effort a significant contributor to the participants overall success in developing resume writing and interviewing techniques.

An in-depth survey of Fast Track graduates by one company indicates a performance range of excellent, good, and fair. A survey of supervisors of Fast Track graduates and graduates of our 4-year engineering program employed by a variety of industries indicates that Fast Track graduates compare favorably with the performance of our 4-year graduates.

Our results and the results of other career facilitation programs indicates the NSF has formulated and funded a successful mechanism for increasing the participation of women in science. We are pursuing the continuation and institutionalization of our program through industry, foundation and other funding sources. We highly recommend that the NSF continue its leadership in this area by increasing support for career facilitation-type programs.

APPENDIX A

MATERIALS TO PROMOTE FAST TRACK PROGRAM

UNIVERSITY OF DAYTON
DAYTON, OHIO 45469

SCHOOL OF ENGINEERING
OFFICE OF THE DEAN

July, 1976

Alumni Office

Dear Sir:

The University of Dayton, School of Engineering, will offer a "Women in Science Career Facilitation Project" January, 1977-December 31, 1977. This project is sponsored by the National Science Foundation and may be of great value to appropriately qualified graduates of your institution. This program is designed to provide a mechanism for women who received a bachelor's or master's degree in chemistry, mathematics, or physics and who graduated between two and fifteen years ago to enter the field of engineering.

In order to announce this program to a broad segment of women who could qualify and may have an interest in such a program, we are asking major universities from a seven state area to provide us with a mailing list (labels, if possible). We would like the mailing list to consist of names and addresses of women who graduated with a B.S. in chemistry, mathematics, physics, chemical engineering, or electrical engineering during the period 1961-1974. If possible, please supply four-up labels in zip code order for graduates who reside in the United States. We realize that an alumni list is a very treasured item and we would therefore guarantee that the mailing list or labels would not be used for any other purpose than the single mailing announcing the program.

As a second option, we would be glad to supply your office with the brochures and you could invoice us for the cost of mailing. I realize that you may be concerned about the privacy act, but I am hopeful that we shall be able to inform your graduates of the nature of this program.

I am looking forward to hearing from you regarding this request.

Sincerely,

Carol M. Shaw

Carol M. Shaw
Associate Professor Chemical Technology
Project Director

David C. Kraft

David C. Kraft, Ph.D.
Dean, School of Engineering

George B. Noland

George B. Noland, Ph.D.
Dean for Graduate Studies and Research

cc: President of each university

PROGRAM OUTLINE

TITLE:	A Fast Track Late Entry Program for Women in Engineering
OBJECTIVE:	The objective of this program is to provide a mechanism for bringing women with a bachelor's degree in chemistry, physics, or chemical technology to an academic level equivalent to current chemical engineering graduates, and for bringing women with a bachelor's degree in physics, mathematics, or electronic engineering technology to the current academic level of electrical engineering graduates.
PARTICIPANTS PROFILE:	Women who received a Bachelor of Science or Master of Science in chemistry, physics, or mathematics and who graduated between 1961 and 1974.
DATE AND LENGTH:	January, 1977-December, 1977.

This program is sponsored by the National Science Foundation.

UNIVERSITY OF DAYTON
DAYTON, OHIO 45469

SCHOOL OF ENGINEERING
OFFICE OF THE DEAN

September, 1976

Alumni Office

Dear Sir:

The Schools of Engineering at the University of California at Davis and the University of Dayton will offer a "Women in Science Career Facilitation Project" during the academic year 1977-78. These projects are sponsored by the National Science Foundation and may be of great value to appropriately qualified graduates of your institution. Each of these programs are designed to provide a mechanism for women who received a bachelor's or master's degree in chemistry, mathematics, physics, or engineering and who graduated between two and fifteen years ago to enter or reenter the field of engineering.

In order to announce this program to a broad segment of women who could qualify and may have an interest in such a program, we are asking major universities in the United States to provide us with a mailing list (labels, if possible). We would like the mailing list to consist of names and addresses of women who graduated with a B.S. in chemistry, mathematics, physics, or engineering during the period 1961-1974. If possible, please supply four-up labels in zip code order for graduates who reside in the United States. We realize that an alumni list is a very treasured item and we would therefore guarantee that the mailing list or labels would not be used for any other purpose than the single mailing announcing these programs. As project director for the University of Dayton, I will coordinate mailing the brochures announcing these programs to your graduates. Please send one set of labels to Carol M. Shaw, University of Dayton, Dayton, Ohio 45469.

As a second option, we would be glad to supply your office with a brochure or announcement of the program (enclosure) and you could invoice us for the cost of mailing. If you choose the second option, please notify each project director individually. I realize that you may be concerned about the privacy act, but I am hopeful that we shall be able to inform your graduates of the nature of this program.

Sincerely,

Carol M. Shaw
Associate Professor
School of Engineering

Donna Frohreich
Project Director
School of Engineering
University of the Pacific
Stockton, California 95211

David C. Kraft, Ph. D.
Dean, School of Engineering
University of Dayton

cc: President of each university. A-4

UNIVERSITY OF DAYTON
DAYTON, OHIO 45469

SCHOOL OF ENGINEERING
OFFICE OF THE DEAN

July 30, 1976

Chamber of Commerce

Dear Sir:

We are writing to request a complimentary copy of your standard booklet or mailing list of industries in your area that would employ scientists or engineers. If your list is divided into industries that employ more than 500 people, please send us only those names of industries employing more than that figure. We wish to contact these industries to alert them to an educational program that may be of interest to their employees.

If complimentary copies are unavailable and there is a substantial fee involved, please contact us before sending the requested information. However, if there is a slight fee, please send the information and bill to:

Mrs. Vivien Pignatiello
KL 201
University of Dayton
Dayton, Ohio 45469

Thank you for your assistance in this matter.

Very truly yours,

Carol M. Shaw

Carol M. Shaw

CMS:vfp

UNIVERSITY OF DAYTON
DAYTON, OHIO 45469

SCHOOL OF ENGINEERING
OFFICE OF THE DEAN

September, 1976

ATTENTION TO THOSE CONCERNED WITH THE DEVELOPMENT OF CORPORATE PERSONNEL

Dear Sir:

The National Science Foundation recently provided funds for the University of Dayton to conduct a Fast-Track Late Entry Program for Women in Engineering. The Fast-Track Late Entry Program is designed for women who received a bachelor's degree between 1961 and 1974 in chemistry, physics, mathematics or a related science and who wish to redirect their career by entering chemical or electrical engineering. Women who majored in chemical or electrical engineering and who have not been practicing engineering may use this program as a means of upgrading their education in order to reenter the engineering profession. There will not be any instructional costs to women who qualify for the program. Complete details of the program are contained in the enclosed brochure and I would appreciate your distributing this brochure to women employees who could possibly benefit from such a program.

Sincerely,

Carol M. Shaw

Carol M. Shaw
Associate Professor
Chemical Technology and
Project Director
Fast-Track Late Entry Program

CMS:vfp
Enclosure

A-6

UNIVERSITY OF DAYTON
DAYTON, OHIO 45469

SCHOOL OF ENGINEERING
OFFICE OF THE DEAN

June, 1978

Alumni Office

Dear Sir:

The University of Dayton, School of Engineering, will offer its second "Women in Science Career Facilitation Project" January, 1979-December 31, 1979. This project is sponsored by the National Science Foundation and may be of great value to appropriately qualified graduates of your institution. This program is designed to provide a mechanism for women who received a bachelor's or master's degree in chemistry, mathematics, or physics to enter the field of engineering.

The University of Dayton offered its first Career Facilitation Program in 1976-77 and 27 of the 31 entering students successfully completed the program. All of these women were offered employment in the engineering field and received commensurate salaries ranging from $16,500 to $19,500.

In order to announce the second program to a broad segment of women who could qualify and may have an interest in such a program, we are again asking major universities to provide us with a mailing list (labels, if possible). We would like the mailing list to consist of names and addresses of women who graduated with a B.S. in chemistry, mathematics, physics, chemical technology, or electronic technology during the period 1950-1977. If possible, please supply Chesire four-up labels in zip code order for graduates who reside in the United States. We realize that an alumni list is a very treasured item and we would therefore guarantee that the mailing list or labels would not be used for any other purpose than the single mailing announcing the program.

As a second option, we would be glad to supply your office with the brochures and you could invoice us for the cost of mailing. I realize that you may be concerned about the privacy act, but I am hopeful that we shall be able to inform your graduates of the nature of this program.

In exchange for providing labels for your graduates, we shall advertise your cooperation by stating on the brochure "The announcement of this program was made possible by your alumni association." We would appreciate receiving the labels by July 20, 1978.

I am looking forward to hearing from you regarding this request.

Sincerely,

Carol M. Shaw
Assistant Dean of Engineering
Project Director

Russell A. Primrose, Ph. D.
Dean, School of Engineering

George B. Nolan, Ph. D.
Dean for Graduate Studies
and Research

CC: President of each university

PROGRAM OUTLINE

TITLE:	A Fast-Track II Late Entry Program for Women in Engineering
OBJECTIVE:	The objective of this program is to provide a mechanism for bringing women with a bachelor's degree in chemistry, physics, or chemical technology to an academic level equivalent to current chemical engineering graduates, and for bringing women with a bachelor's degree in physics, mathematics, or electronic technology to the current academic level of electrical engineering graduates.
PARTICIPANTS PROFILE:	Women who received a Bachelor of Science or Master of Science in chemistry, physics, or mathematics and who graduated between 1950 and 1977.
DATE AND LENGTH:	January, 1979 - December, 1979.

This is a tuition free program funded by the National Science Foundation.

Additional stipends are available for living expenses.

WOMEN INTERESTED IN ENGINEERING?

UPGRADE YOUR EDUCATION—REDIRECT YOUR CAREER—AT NO COST FOR TUITION—IN THIS NSF-FUNDED FAST-TRACK LATE ENTRY PROGRAM

If you have a B.S. degree in mathematics, chemistry, physics, or a related science . . . .

Your career opportunities could be enhanced by an engineering background . . . .

The University of Dayton FAST-TRACK LATE ENTRY PROGRAM opens the door to you for job advancement or greater professional fulfillment.

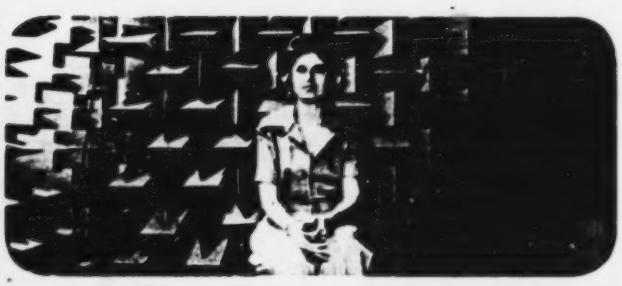
PROGRAM OBJECTIVES!

To advance holders of bachelors degrees in certain fields to the current academic level of engineering graduates

- Chemistry, physics, mathematics or a related science to a level equivalent to current chemical engineering graduates
- Physics, mathematics, or a related science to a level equivalent to current electrical engineering graduates
- At no instructional cost to you!

WHAT IS A "FAST-TRACK" PROGRAM?

A Fast-Track Program provides—assessment of background; assistance in choosing courses; instruction, labs, a professional development course, and guidance; and the achievement of an upgraded or redirected education—all within a relatively short 11-½ months.



WHY ENGINEERING NOW?

Engineering has been a predominantly male profession, but now, a breakthrough is opening it up for women. Engineering, on the average, offers higher salaries and greater opportunity for advancement than chemistry, physics, or mathematics. HERE'S WHY: Demand for women engineering graduates far exceeds the supply. In 1974, women represented only 1.6 percent of the engineering graduates; BY COMPARISON women represented 20 percent of the chemistry graduates, 8 percent of the physics graduates, and 41 percent of the mathematics graduates.[1] THIS PATTERN OF FEW WOMEN ENGINEERING GRADUATES, COUPLED WITH THE DEMAND FOR ENGINEERS, PROVIDES AN EXCELLENT CAREER OPPORTUNITY FOR YOU!

CHEMICAL AND ELECTRICAL ENGINEERING

In order for a Late Entry program to be "Fast-Tracked" there must be a link between the Fast-Track engineering curriculum and the area in which potential program participants received their earlier training. Due to the similarity and overlap of the academic backgrounds of chemists, physicists and mathematicians and programs in chemical or electrical engineering, chemists, physicists and mathematicians can be "Fast-Tracked" to function as chemical engineers and physicists and mathematicians can be "Fast-Tracked" to function as electrical engineers.

THE DESIRABILITY OF THIS PROGRAM IS EMPHASIZED BY TWO FACTS: (A) TOP JOB AND SALARY OFFERS FOR CHEMICAL ENGINEERS AND ELECTRICAL ENGINEERS, (B) KEEN COMPETITION FOR EMPLOYMENT IN THE FIELD OF MATHEMATICS, WHERE WOMEN COMPRISE A COMPARATIVELY LARGER PERCENTAGE OF GRADUATES.

WHO CAN QUALIFY?

Women who received a Bachelor's or Master's degree in chemistry, mathematics, physics, or a related field and who graduated before December, 1977.

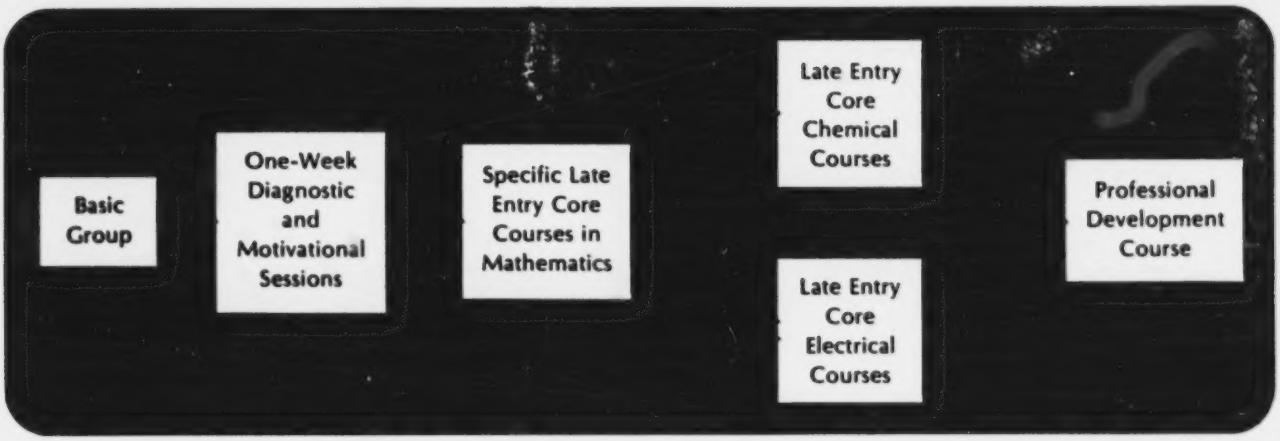
[1]Digest of Educational Statistics, *Earned Degrees Conferred*, W. Vance Grant and C. George Lend, National Center for Educational Statistics.

THE FAST-TRACK LATE ENTRY PROGRAM IS FUNDED BY THE NATIONAL SCIENCE FOUNDATION

Special recognition is given to the many university alumni associations for their cooperation in publicizing this program.

ACTIVITY PLAN

Women accepted into the FAST-TRACK LATE ENTRY PROGRAM will attend the University of Dayton on a full-time basis for 11-½ months from January to December, 1979. Regular University holidays will be observed.


Basic Group
One-Week Diagnostic and Motivational Sessions
Specific Late Entry Core Courses in Mathematics
Late Entry Core Chemical Courses
Late Entry Core Electrical Courses
Professional Development Course

PROGRAM FORMAT

The FAST-TRACK LATE ENTRY PROGRAM consists of:

1. Procedures to diagnose and evaluate the backgrounds of program participants;
2. A one-week motivational and final diagnostic counseling session held before formal entrance into the courses;
3. Basic engineering and math curricula that will be taken by a majority of the participants in the chemical track and some participants in the electrical track. The majority of participants in the electrical track are expected not to need the mathematics sequence;
4. Specific chemical and electrical core courses taken toward different career paths;
5. A professional development course that will cover a wide range of careering, nontechnical, and professional development skills—a three semester course;
6. Immediate-response problem sessions and
7. Placement services.

SPECIAL FEATURES

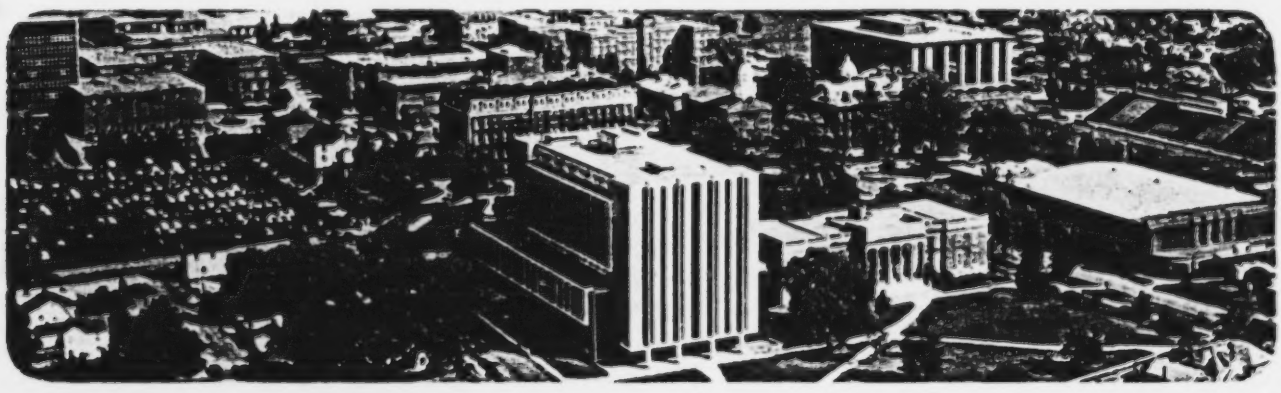
The goal is to provide confidence for the work that lies ahead. Therefore, prior to formal entrance into program, participants will take part in a series of experiences designed to provide this psychological reinforcement. These experiences will include: Interaction with late entry women engineers who are successfully employed, including Fast-Track I graduates.

THE PROFESSIONAL DEVELOPMENT COURSE

The goal of the Professional Development Course will be to maximize the participant's self-concepts as professional engineers, with strong personal career directions based on individual strengths, interests, and technical abilities. The incorporation of the Professional Development Course into the Fast-Track II curriculum will produce a more employable graduate who can quickly be productive in a first engineering job.

IMMEDIATE RESPONSE PROBLEM SESSIONS

Immediate response problem sessions will provide academic help for any member who may need more attention in covering particular course material. The number and intensity of problem sessions per week will vary, depending upon the needs of the class. In order to initiate more than the minimum number of problem sessions, any member of the class may contact the graduate assistant, the principal professor, or the project director.



Fast-Track I was successful in terms of industry's reception to the program and in terms of the Fast-Track student's academic performance when compared to undergraduate students in the traditional four-year curriculum. Placement in industry resulted in offers for chemical and electrical engineering being above the average of regular graduates. On the average, there were three job offers per student.

The instructional costs are being supported by the National Science Foundation. In addition, program participants will be eligible to apply for stipends that will cover some portion of living expenses during the program. The additional stipends will be awarded on the basis of need.

Full academic credit for all courses taken in the FAST-TRACK LATE ENTRY PROGRAM will be granted by the University of Dayton.

The electrical and chemical curriculum satisfies the Engineering school requirements for a second bachelor's degree in chemical or electrical engineering. Participants will also have to satisfy University nontechnical requirements in order to receive the degree. *A certificate describing the academic nature of this program will be awarded in each participant upon completing the minimum number of credit hours (30) required in a FAST-TRACK LATE ENTRY PROGRAM.*

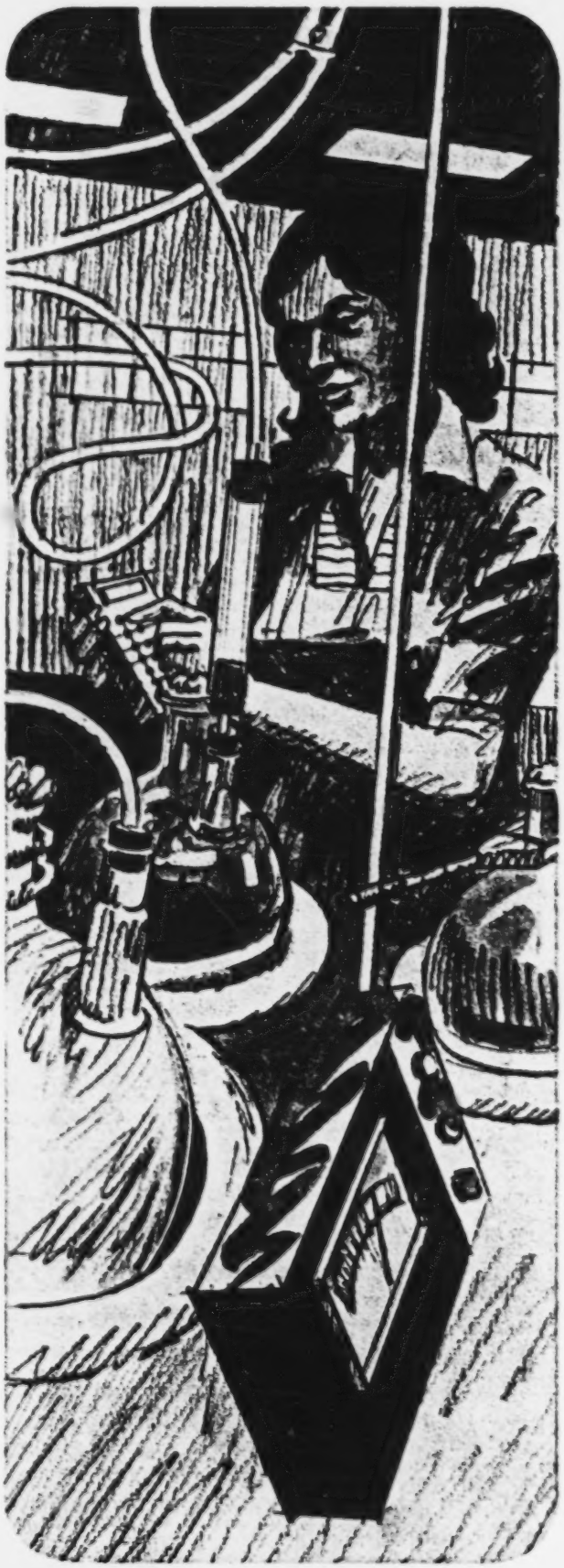
Completion of the FAST-TRACK LATE ENTRY PROGRAM will prepare each student for graduate study in chemical or electrical engineering, provided normal entrance requirements are met.

Applicants will be selected by a committee of the School of Engineering, on the basis of academic credentials, prior work experience, and commitment to the program.

An application for the FAST-TRACK LATE ENTRY PROGRAM will be sent upon return of the enclosed postcard, or call Professor Carol M. Shaw at (513) 229-2736.

Applications should be returned by October 10, 1978. Late applicants will be considered if openings exist.

The University of Dayton is a private university with a history of excellence in education since 1850. Engineering education began at the University of Dayton in 1910 when a degree program in chemical engineering was initiated. The School of Engineering has 58 full-time faculty members and grants the Bachelor of Science degree in chemical, civil, electrical, industrial and systems, and mechanical engineering. The School of Engineering also grants the Master's, Ph.D., and D.E. degrees. The $7.5 million Eugene W. Kettering Engineering and Research Laboratories, built in 1970, provides classrooms, 88 instructional and research laboratories, and a modern environment for the study of engineering.



ORIENTATION AND MOTIVATIONAL WEEK — JANUARY 8 - 12, 1979

CHEMICAL ENGINEERING PROGRAM

TERM I — **January 16 — April 27, 1979**

Course Length in Weeks	Hours	Course Number and Title
7	3	MTH 490 Special Topics in Mathematics
7	3	CME 203 Material & Energy Balances
7	3	MTH 219 Applied Differential Equations
7	3	CME 305 Thermodynamics
**	1	EGI 499 Professional Development Course

TERM II — **May 3 — July 27, 1979***

Course Length in Weeks	Hours	Course Number and Title
12	3	ELE 321 Basic Electric Theory
12	3	CME 306 Kinetics
6	3	CME 324 Transport Phenomena I
6	3	CME 325 Transport Phenomena II

TERM III — **August 27 — December 14, 1979***

Course Length in Weeks	Hours	Course Number and Title
15	2	CME 413L Unit Operations Laboratory
15	3	CME 452 Process Control
7	3	CME 411 Unit Operations I
7	3	CME 412 Unit Operations II
7	3	CME 430 Chemical Engineering Design

ELECTRICAL ENGINEERING PROGRAM

TERM I

Course Length in Weeks	Hours	Course Number and Title
7	2	ELE 499 Special Problems in Circuit Analysis
14	3	ELE 499 Special Problems in Field Theory
14	3	EGM 499 Special Problems in Mechanics/Dynamics
7	2	ELE 499 Special Problems in Electrical Devices
7	1	ELE 499 Special Problems Circuit & Instrumentation Lab
**	1	EGI 499 Professional Development Course

TERM II

Course Length in Weeks	Hours	Course Number and Title
12	3	ELE 312 Engineering Electronics
12	3	ELE 332 Circuit Theory IV
12	3	ELE 431 Energy Conversion or OPTION
	3	ELE 334 Field Theory III
12	3	CME 305 Thermodynamics
12	1	ELE 499 Special Problems Electronic Systems Lab

TERM III

Course Length in Weeks	Hours	Course Number and Title
15	3	ELE 413 Communication Engineering
15	3	ELE 531 Digital Systems Theory
15	3	ELE 432 Automatic Control Systems
15	1	ELE 499 Special Problems Electrical Systems Lab

** **Professional Development Course will be taught throughout the program.**

***These are tentative dates and subject to change.**

The curriculum shown above fulfills the **Engineering school requirements** *for a second bachelor's degree in chemical or electrical engineering for selected participants.*

FAST-TRACK II BEGINS JANUARY, 1979

YES! A FAST-TRACK ENGINEERING PROGRAM SHOULD BE IN YOUR FUTURE TODAY!!!

APPENDIX B

COPIES OF NEWS ARTICLES

Programs Help Women Reenter Field

Women who previously earned bachelor's degrees in science or engineering will have an opportunity to enter or reenter the field of engineering in three separate programs sponsored by the National Science Foundation. The programs each offer unique features and will be held on the campuses of the University of California at Davis, the University of Dayton, and the University of Notre Dame.

The University of California program is an intensive 14 month program that will provide participants with skills to make them eligible for employment in engineering or provide the background to compete successfully in graduate programs in engineering. The program begins in July with a two-week session and will be followed by additional weekend classes, concluding with a two-week session the following July. An integral part of the program will be the opportunity to gain practical experience through cooperative engineering jobs. Academic elements of the program include a review of mathematics, physics and computer programming before entrance into engineering courses.

The University of Dayton's Fast-Track Late Entry Program offers yet another mechanism for entering or reentering the engineering profession. Women selected for the program will enroll in one of two engineering tracks —chemical or electrical. The one-year program offers a review of mathematics and intensive course work in either chemical or electrical engineering. Special features include a one-week motivational, counseling, and diagnostic session, immediate response problem sessions, and placement efforts upon completion of the program. Women who complete the program will receive 26 hours of academic credit for the specially designed engineering courses and will be awarded a certificate. The program begins January 18, 1977 and concludes the following December.

The University of Notre Dame program for career upgrading or retraining is also designed for women who hold bachelor's degrees in biology, chemistry, computer science, engineering, and mathematics. This program employs a multifrontal approach because of the varied backgrounds of the program participants. Notre Dame will attempt to update each woman in her degree field to a level of knowledge expected of a current graduate in that field, to introduce the field of environmental health engineering and science, and to develop skills needed for each woman to enter and successfully complete a graduate training program in the environmental health area. Women interested in this program may enroll in one of four 12 week training sessions. Training sessions begin on January 17, 1977; May 30, 1977; September 5, 1977; and January 16, 1978.

Women interested in these programs should apply immediately by contacting the appropriate project directors:

Donna Frohreich, University of California at Davis

Lloyd Ketchum, University of Notre Dame

Carol M. Shaw, University of Dayton.

Coming Events

ASEE events in boldface

november

5-6 Middle Atlantic Section Annual Meeting, Westburn, N.Y.

6-10 Engineering in Medicine & Biology Annual Conference, Sheraton-Boston

10-13 Society for Advanced Medical Systems Annual Conference, Sheraton-Boston

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WHAT SHOULD THE CES DIVISION DO IN THE NEXT TWELVE MONTHS?

Joe Biedenbach

The Chairman and an assembled group evaluated a list of possible areas of worthwhile activities and selected those on which they felt the Division's resources should be concentrated during the next 12 months. The result was three first order activities and five second order activities. The first order activities are:

1. Conduct a CES workshop just before or just after the annual ASEE meeting. Use the general format used by the ERM's National Effective Teaching Institutes. Workshop to deal with, among other things, adult education/learning principles and how to develop, market, conduct, and evaluate CES activities. (Chuck Sener will do one; Lois Greenfield and Dean Griffin looking at another; Alden Jones is formating a third.)

2. Seek to foster the professional development of CES practitioners (growth in adult education/learning principles).

3. Reinstitute the "cracker barrel" session at CES Division meetings. (Lee Phillips is initiating this for the San Antonio Conference.)

The second order activities selected by the group are as follows:

1. Redefine or reaffirm the role of the Section Representative and develop means of supporting the Section Representative in their work.

2. Increase communication within the Division through more effective use of new or old publications. Perhaps make the CES Division Newsletter into something like the ERM Magazine -- communicate examples of CES implementation -- publish meeting papers and send to members.

3. Develop ways to attract and involve more new members.

4. Present a plenary session on adult education at the Annual ASEE Meeting next year; then build on that with two other CES sessions at the following annual ASEE meeting.

5. Update the CES Division Directory, and develop a list of ASEE members whose primary interest is CES (code 15). (Stan Greenwald and Joe Biedenbach are going ahead with this.)

• • •

NSF GRANTS FOR WOMEN'S PROGRAMS IN ENGINEERING

Women who previously earned bachelor's degrees in science or engineering will have an opportunity to enter or reenter the field of engineering in three separate programs sponsored by the National Science Foundation. The programs each offer unique features and will be held on the campuses of the University of California at Davis, the University of Dayton, and the University of Notre Dame.

The University of California program is an intensive 14 month program which will provide participants with skills that make them eligible for employment in engineering or provide the background to compete successfully in graduate programs in engineering. The program begins in July with a two-week session and will be followed by additional weekend classes, concluding with a second two-week session the following July. An integral part of the program will be the opportunity to gain practical experience through co-operative engineering jobs. Academic elements of the program include a review of mathematics, physics and computer programming before entrance into engineering courses.

The University of Dayton's Fast-Track Late Entry Program offers yet another mechanism for entering or reentering the engineering profession. Women selected for the program will enroll in one of two engineering tracks -- chemical or electrical. This one-year program includes a review of mathematics and intensive course work in either chemical or electrical engineering. Special features of the Fast-Track Program include a one-week motivational, counseling, and diagnostic session, immediate response problem sessions, and placement efforts upon completion of the program. Women who complete the program will receive 26 hours of academic credit for the specially designed engineering courses and will be awarded a certificate upon completion of the program. The program begins January 18, 1977 and concludes the following December.

The University of Notre Dame program for career upgrading or retraining is also designed for women who hold bachelor's degrees in biology, chemistry, computer science, engineering, and mathematics. This program employs a multifrontal approach because of the wide variety of backgrounds of program participants. The University of Notre Dame program will attempt to update each woman in her degree field to a level of knowledge expected of a current graduate in the same degree field, to introduce the field of environmental health engineering and science, and to develop skills necessary for each woman to enter and successfully complete a graduate training program in environmental health engineering and science. Women interested in this program may enroll in one of four 12 week training sessions. Training sessions begin on January 17, 1977; May 30, 1977; September 5, 1977; and January 16, 1978.

Women interested in these programs should apply by contacting the appropriate project directors:

Donna Frohreich, University of California at Davis

Lloyd Ketchum, University of Notre Dame

Carol M. Shaw, University of Dayton

UD—a leader

NSF backs women in engineering

The University of Dayton is one of three universities in the nation which has received grants from the National Science Foundation for programs designed to retrain women who are interested in careers in engineering education. The other two universities were Notre Dame and California at Davis.

The one grant for $111,944 will be used for the design and implementation of a one-and-half year late-entry program for women who are interested in moving toward careers in chemical or electrical engineering. A second grant for $9,940 will be used to plan a weekend workshop slated in February when women from Ohio colleges will be presented with the options available to them in science and engineering. UD was the only school in the nation to receive a career facilitation grant to be used for such a program as the late entry program.

The Fast Track Late Entry Program is designed for women who earned undergraduate degrees in math, chemistry and physics between 1961 and 1974 and would like to respond to the current demand for women in engineering. The academic part of the program will begin in January, 1977. The grant will be used to sponsor scholarships for the approximately 40 women who will enroll. Tentative deadline for application is Oct. 30.

Students in the late entry program will be enrolled full time in one of two paths which will lead either to a career in chemical or electrical engineering. Women with math, science, chemistry or commensurate backgrounds are being sought, according to Carol M. Shaw, (chemical engineering technology), coordinator of the program, because their academic backgrounds would facilitate a transfer to a closely related engineering discipline. "The demand is there," she explains. "In 1974 women comprised 1.6 per cent of the engineering graduates, eight per cent of the physics graduates and 41 per cent of the mathematics graduates. This historic pattern of few women engineering graduates combined with the current demand for engineers provides an excellent opportunity for those women interested in an engineering career."

The program will begin with a week-long session aimed at psychological motivation and re-enforcement of the participant's decision to obtain credentials in the engineering profession. Panel discussions will focus on problems encountered by professional women in contemporary society. Women with experience as professional engineers will be available for role model identification.

UD has been involved in a previous project with the Monsanto Research Corp. to re-train their personnel to become qualified chemical engineers.

Shaw also has directed the Women in Engineering programs held for the past three summers on the UD campus. The workshops enabled high school age women to investigate the possibility of careers in engineering.

"Of course," said Shaw, "the test of all our programs is whether the people we educate can function as engineers. We have acquired enough experience in adult education and re-training to gain an insight into what education is needed for professional competence."

- Patricia Rooney

Carol Shaw [above], winner of two recent NSF grants, has also directed programs at UD for the last three summers to acquaint high school women with the field of engineering. Diane Thompson [below], a co-op student in engineering working at Delco Moraine, helped with last summer's program.

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This Year, For Women

The end of the year is a time for overviews -- for wrap-up articles showing where we've been and what we've accomplished. For women in education, the year included many new advancement programs. Here are a few examples in science, in sports, and in management.

The American University received an NSF grant to help attract and retain women in scientific careers. A tuition-free project, it is directed toward women who earned degrees in chemistry between two and 15 years ago and who are not now employed in the field. Contact: Cindy Moran, director public information, Massachusetts and Nebraska Aves., NW, Washington, DC 20016. (202) 686-2100.

To help women move toward careers in chemical or electrical engineering, the University of Dayton offers a new program. The Fast Track Late Entry Program has scholarships for women graduating between 1961 and 1974 in math, chemistry, and physics. Contact: Mark Pomerleau, director information services, University of Dayton, Dayton, Ohio 45469. (613) 229-3241.

Women athletes at George Washington University share $90,000 in scholarships for eight sports. Grants range from $300 to full tuition ($2,600). Contact Assoc. Prof. Lynn George, director of athletics for women, GWU, Washington, DC 20052. (202) 676-6283.

Ohio State University offers 30 full grants to women competing in 12 sports. Grants total $88,515. Contact Bill Merriman, director of communications, OSU, Columbus, Ohio 43210. (614) 422-3010.

Simmons College offers an undergraduate degree in banking management for women. Twice-yearly intensive institutes, class work, and on-the-job training are parts of the program, co-sponsored by the National Association of Bank Women. Contact Maria Melnyk, Simmons College, office of public information, 300 The Fenway, Boston, Massachusetts 02115. (617) 738-2124.

Management Training for Women is the focus of a November seminar sponsored by Georgetown University. Contact Joseph Pettit, dean, School for Summer and Continuing Education, RCA Building - Education Center 1901 N. Moore St., Rosslyn, Virginia 22209. (703) 525-6300.

The Institute for Administrative Advancement at the University of Wisconsin trains women faculty members for positions in administration. Contact Dr. Virginia Nordin, IAA, University Wisconsin, Madison, WI 53706. (608) 263-6784.

Women seeking advancement in educational administration may join the four-week summer institute at Bryn Mawr College. Co-sponsored by HERS (Higher Education Resource Services), the program requires a commitment of time and money for those seeking senior positions. Contact Michelle Osborn, Bryn Mawr College, Bryn Mawr, Pennsylvania 19010. (215) 525-1000, extension 295.

Ursuline College Women In Management Sequence involves seven courses in management skills with an optional internship. Contact Pat Moore, public relations, Lander Road and Fairmount, Pepper Pike, Cleveland, Ohio 44124. (216) 449-4200.

Room at the Top is an academic program for Illinois Wesleyan University women majoring in business fields. Co-sponsored by Country Companies Insurance group, it is designed to prepare women for careers in business management. Contact Jerry Bidle, director of public relations, Bloomington, Illinois 61701. (309) 556-3091.

For more information about advancements for women in education, contact the following:

Dr. Emily Taylor, director, American Council on Education, Office of Women in Higher Education, Suite 800, One Dupont Circle, Washington, DC 20036. (202) 833-4700.

Bernice Sandler, project director, Association of American Colleges' Project on the Status and Education of Women, 1818 R Street NW, Washington, DC 20009. (202) 387-1300.

Elizabeth Wells, national Coordinator, American Association for Higher Education, Women's Caucus, Suite 780, One Dupont Circle, Washington, DC 20036. (202) 293-6440.

Evansville, Indiana. Dr. Amer did his undergraduate work at the University of Alexandria and received his M.S. and Ph.D. from the University of Illinois College of Medicine. Dr. Amer is a member of many scientific socieites, has been a participant in a number of national and international scientific symposia, and is the author or co-author of over sixty articles and communications.

There are a number of sites at which drugs can affect the cyclic nucleotide system. Some of these sites are more attractive for drug development where tissue selectivity, specificity of desirable actions and minimal side effects are of paramount importance. Greater understanding of the factors operating at these sites and their susceptability to drug effects must be achieved before successful and deliberate design of useful drug entities can be made. The involvement of cyclic nucleotides in disease makes it, at least theoretically, possible to produce agents that could correct the basic metabolic disease-associated abnormalities and thus be more curative than presently available drugs.

Possibilities also exist for prophylactic approaches designed to minimize or even circumvent the disease-associated changes in cyclic nucleotide metabolism. The close association and collaboration between the biochemical pharmacologists, chemists and other biologists coupled with the long term commitment of the pharmaceutical industry, can move these considerations from the realm of possibilities into the realm of reality for the good of all.

Cincinnati Chemist Award Nominations Due

December 31, 1976 is the deadline for submitting nominations for the 1977 Cincinnati Chemist Award. The award will be presented at the regular meeting of the Cincinnati Section on February 9, 1977, and is given annually to a member of the Section in recognition of contributions to the scientific community in the field of research or education. The recipient of the award will be the speaker of the evening.

Nominations should be accompanied by a description of the candidate's career and professional accomplishments. Please send them to Dr. Harry B. Mark, Jr., Chairman of the Awards Committee, Department of Chemistry, University of Cincinnati, Cincinnati, Ohio 45221. For further information or assistance, please contact Dr. Mark at 475-2263.

PROGRAM

6:00 P.M.	Social Hour, sponsored by The Drackett Company and Merrell-National Laboratories
7:00 P.M.	Dinner, Windjammer Buffet $11/person
8:00 P.M.	Dr. M. Samir Amer, Mead Johnson *"Cyclic Nucleotides and Drug Development"*

Reservations MUST be made for the dinner and may be obtained by calling Jim Niewahner at 292-5404 (office) or 781-1098 (home) by 12:00 noon Monday, November 8.

FAST-TRACK LATE ENTRY PROGRAM FOR WOMEN IN ENGINEERING

The University of Dayton is conducting an NSF sponsored program entitled *"A Fast-Track Late Entry Program for Women in Engineering."* The program is designed to advance holders of bachelors degrees in certain fields to the current academic level of engineering degrees within a relatively short period of time and is a mechanism for entry into the field of engineering. The program includes a tuition-free 11½ month course of instruction running from January to December, 1977. To be eligible, applicants must hold bachelors degrees in chemistry, physics, mathematics, or related sciences. The official deadline for application is November 30, 1976 but it is requested that applications be filed as early as possible. For more information and application instructions write Professor Carol M. Shaw, University of Dayton, 300 College Park, Dayton, Ohio 45469 or call Professor Shaw at (513) 229-3621.

Women Chemists Needed As Participants In One Day Undergraduate Workshop

The University of Dayton is planning a one-day workshop entitled *"A Woman in Science and Engineering Career Workshop"* to be held on February 8, 1977. Women chemists are needed to serve as leaders and role models. The workshop will serve freshman and sophomore college women from the fourteen schools in the Dayton-Miami Valley Consortium of Schools and is intended to encourage these women to major or continue to major in science and engineering and to provide them information about career opportunities in these fields. Women chemists interested in participating should contact Professor Carol M. Shaw, University of Dayton, Dayton, Ohio 45469 or call Professor Shaw at (513) 229-3621.

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Case Alumnus
Oct 1976
pg 6

[illegible] two years each in Tegucigalpa, Honduras, Milan, Italy, and Guayaquil, Ecuador. In his position, Zettler's primary job is to promote U.S. exports and protect U.S. businesses in the countries where he is assigned. He also takes a turn as embassy or consulate duty officer, providing 24-hour aid to Americans in distress in foreign lands. Prior to taking the U.S. Foreign Service test and beginning his career, Zettler was a chemical marketing project manager in Cleveland.

Manages Power Plant

Selection of ANDREW T. MULATO'56 to be manager, Muskingum River Plant, Ohio Power Co., Beverly, Ohio, has been announced. He is a veteran of 21 years' experience with the American Electric Power System of which Ohio Power Co. is a part. Prior to this promotion, Mulato was assistant manager of the General James M. Gavin Plant, Cheshire, Ohio. He has been with the firm since 1955, starting as a test engineer at Tidd Plant, Brilliant, Ohio. Mulato then became maintenance foreman in 1963 and moved to Muskingum River Plant in 1966 as a performance engineer. He was in New York, N.Y., for two years at the AEP Service Corp. to prepare for a future assignment at the System's first nuclear power plant. In 1970, Mulato was assigned to the Donald C. Cook Nuclear Plant, Bridgman, Mich., as a maintenance supervisor and then moved to the Gavin Plant in 1972.

Heads Plant Personnel

Appointment of DWAYNE E. MORRISON'65 to personnel manager, Metals Plant, TRW Inc., Minerva, Ohio, has been announced by Dr. Edward A. [illegible]

Wanted: Students

WOMEN WHO have received bachelors or masters degrees in chemistry, mathematics, physics or a related science and who graduated between 2 and 15 years ago are being offered a program designed to enable them to enter the field of engineering. The project is sponsored by the National Science Foundation and is given at the School of Engineering, University of Dayton, Dayton, Ohio 45469. It is a "Women in Science Career Facilitation Project" January 1977-December 1977. There is no charge to the students for instructional costs. Candidates who desire application material and additional information may write Prof. Carol M. Shaw, Associate Professor Chemical Technology, University of Dayton. □

Designs Satellite Products

Engaged in the design and production of equipment used in satellite communications is Symetrics Industries Inc., Indian Harbour Beach, Fla., headed by JOHN T. JACKSON'52. He joined the firm in 1962 as controller. Symetrics recently completed a Satellite Communications Training System to be used by the U.S. Army Signal Corps. It is currently in the process of building a group of 30 ground terminals for weather satellite communi[illegible]

...aces

...ree-year $75,000 grant in support of ...ndergraduate energy studies and ma...erials programs has been awarded to ...olytechnic Institute of New York by ...General Electric Foundation.

The University of New Haven has been ...ppointed an Aviation Education Re...source Center for the state of Connecti...cut by the General Aviation Manufac...turer's Association. This program is a ...operative venture between the educa...tion community and the aviation indus...try aimed at increasing public awareness ...aviation and providing information ...career opportunities.

The University of California at Los ...geles has established an Institute for Medical Engineering. Initial support for ...new research unit will be provided ...Mr. and Mrs. Ralph E. Crump.

Worcester Polytechnic Institute has ...ceived a grant of $123,000 from Lilly ...ndowment, Inc., to extend its empha...sis on social science and the humanities ...the WPI curriculum. The purpose of ...e grant is to develop, during a two-...year project, a "technological huma...nism program: values formation in pro...ssional education."

Francis G. Tatnall, a pioneer in the field of materials testing, has been named to the Gallery of Distinguished Engineering Alumni of the **University of Pennsylvania.** Tatnall is a director of Vishay Intertechnology, Inc., of Malvern, Pa., a manufacturer of precision resistors, strain gages, and photoelastic equipment.

Mo-Shing Chen, professor of electrical engineering and director of the Energy System Research Center at the **University of Texas at Arlington,** was presented the first Power Engineering Educator Award at the 44th Edison Electric Institute Annual Convention. Dr. Chen was honored for his superb teaching accomplishments in the field of power engineering.

Glenn R. Swetman, professor of English at **Nicholls State University,** was elected president of the National Federation of State Poetry Societies at its bicentennial convention this summer. Swetman, a published poet, teaches both creative writing and engineering writing.

Frederick D. Rossini, professor emeritus at **Rice University,** has been awarded Germany's Carl Engler Medal by the German Society for Petroleum Science and Coal Chemistry. The medal recognizes Dr. Rossini's outstanding contributions to petroleum research over the past several decades.

Joseph Bordogna, professor of electrical engineering and associate dean at the **University of Pennsylvania,** has been appointed as the new director of t... Moore School of Electrical Engineering at the University, which includes the Departments of Electrical Engineering and Science, Computer and Information Science, and Systems Engineering.

Jay B. McGarraugh, professor of civil engineering at the **University of Missouri-Columbia,** is one of four faculty members selected for recognition for superior undergraduate teaching. McGarraugh will receive an award of $500, made possible by a gift to the University from the Amoco Foundation.

The University of Dayton has received a grant of $111,944 from the National Science Foundation for the design and implementation of a one and a half year late entry program for women who are interested in moving toward careers in chemical or electrical engineering. The grant will sponsor scholarships for 40 women who earned undergraduate degrees in math, chemistry, and physics between 1961 and 1974, who want to move into engineering.

Schedule of NSF Programs for Education in the Sciences—Fiscal Year 1977

This consolidated table presents important time-schedule information concerning NSF programs for education in the sciences. It is intended as a convenient reference for: (1) individuals applying for fellowships and (2) institutions submitting proposals for the conduct of all other listed programs and projects. Although application closing dates are firm, award dates are approximate.

INFORMATION FOR FELLOWSHIP APPLICANTS

	Program Announcement Dates	Application Closing Dates	Award Announcement Dates	Pertinent Publications
FELLOWSHIPS				
Graduate Academic Year 1977-78	Sept. 1976	Nov. 29, 1976	March 15, 1977	GE-77-10

Catholic Telegraph 9-3-76

UD to Retrain Women in Engineering Field

A "late entry" retraining program for women who already have their undergraduate degrees and wish to enter the field of chemical or electrical engineering has been announced by the University of Dayton.

The National Science Foundation has provided UD with a grant of $111,944 for the one-and-a-half-year program.

The program is designed for women who earned undergraduate degrees in mathematics, chemistry and physics between 1961 and 1974. The academic part of the program will begin in January. Tentative deadline for applications is Oct. 30.

The federal grant will be used to sponsor scholarships for approximately 40 women. Students will be enrolled full time in programs leading to careers in either chemical or electrical engineering.

According to Carol M. Shaw, associate professor in the school of engineering, women last year comprised only 1.6 per cent of the engineering graduates, 20 per cent of the chemistry graduates, eight per cent of the physics graduates and 41 per cent of the mathematics graduates.

This historic pattern of few women engineering graduates, combined with the current demand for engineers, provides an excellent opportunity for those women interested in an engineering career," she said.

The program will begin with a week-long session aimed at psychological motivation and reenforcement of the participant's decision to seek credentials in engineering. Problems encountered by professional women will be discussed.

Professor Shaw also announced that the National Science Foundation has approved another grant, amounting to $9,940, for a weekend workshop in February at which women from Ohio colleges will learn the options available to them in the science and engineering fields.

UD is the only one of 33 institutions to receive a grant for both the "late entry" and workshop programs. UD has been involved in a previous project with the Monsanto Research corporation to retrain their personnel to become qualified chemical engineers. Professor Shaw also has directed the "Women in Engineering" programs for the past three summers on the UD campus to help high school students investigate engineering as a career.

CT
9-3-76

Dayton Daily News, 1976

UD recruiting women for engineering degree

The University of Dayton is recruiting women with science backgrounds to enter a special program that will grant an engineering degree in a year and a half.

UD received a $111,944 National Science Foundation grant to design and carry out the program, coordinated by Associate Professor of Engineering Carol M. Shaw.

Shaw said the grant will provide scholarships for about 40 women, who will be trained in either chemical or electrical engineering.

Shaw said there are excellent opportunities in the job market for women with engineering degrees.

Women who earned a degree in science after 1961 are particualarly well qualified for the program, Shaw said. Applications should be made to UD by Oct. 30, she said.

Journal Herald, Dayton, Ohio

September 16, 1976

Engineer training

JH 9-16

UD gets grant for women

The University of Dayton is one of three universities in the nation to receive a National Science Foundation grant designed to retrain women who are interested in careers in engineering.

The program is geared toward women with undergraduate degrees in math, chemistry and physics, earned between 1961 and 1974, who are now interested in careers in chemical or electrical engineering.

The $111,944 grant will supply full scholarships to approximately 40 women who enroll full-time for a year. The foundation also awarded engineering retraining grants for women to the University of Notre Dame and the University of California.

Carol M. Shaw, program creator and co-ordinator for UD, said it was an excellent opportunity for women who find themselves unemployed or underemployed.

"The demand for women engineers is there," she said.

"In 1974 women comprised 1.6 percent of the engineering graduates, 20 percent of the chemistry graduates, 8 percent of the physics graduates and 41 percent of the mathematics graduates. This historic pattern of few women engineering graduates combined with the current demand for engineers prov[illegible] excellent opportunity for those women inter[illegible] an engineering career."

The deadline for application is Oct. 30.

THE SENTINEL
TROTWOOD, O.
W-CIRC. 1300

282

SEP-15-76

UD receives grant for women in engineering

The University of Dayton has received a grant of $111,944 from the National Science Foundation for the design and implementation of a one and a half year late entry program for women who are interested in moving toward careers in chemical or electrical engineering.

The Fast Track Late Entry Program is designed for women who earned undergraduate degrees in math, chemistry and physics between 1961 and 1974 and

another proposal for a $9,940 grant, also approved by the National Science Foundation, for a weekend workshop slated in February when women from Ohio colleges will be presented with the options available to them in science and engineering.

UD was the only one of 33 institutions to receive a grant for both the year-long late entry program and the workshop. Program design, realizable objectives and UD's School of Engineering's previous experience in related type programs and in recruiting women and minorities were cited as reasons for the approval of the grant.

UD has been involved in a previous project with the Monsanto Research Corp. to re-train their personnel to become qualified chemical engineers. Prof. Shaw also has directed the Women in Engineering programs held for the past three summers on the UD campus. The workshops enabled high school age women to investigate the possibility of careers in engineering.

"Of course," said Prof. Shaw, "the test of all our programs is whether the people we educate can function as engineers. We have acquired enough experience in adult education and re-training to gain an insight into what education is needed for professional competence."

Despite credentials

Women worry about success in engineering

Although the twenty-nine women accepted into UD's late entry engineering program have excellent credentials, some of them have doubts about their success.

For that reason the first week - January 18-21 - of the $111,944 program funded by the National Science Foundation will be devoted to the topic of motivation. The program will begin at 10 a.m., Tuesday with a panel of older women who have found success after mid-career changes to engineering.

Motivation also was a factor in the addition of a new member to the staff, according to Carol M. Shaw, director of the program and associate professor of chemical technology.

Nancy Cook Cherry, a psychologist with extensive experience in women's programs, had her initiation into the program when she helped Shaw make the some 25 telephone calls to women who had been accepted into the program but had last-minute doubts about their ability.

"When you're talking to a woman with a straight A average, there's absolutely no reason why she should have doubts about her ability to do well in the program," Shaw said, adding, "I'm convinced that a similar group of men with C averages would not have the same kinds of hesitancies."

One third of the women in the program have master's degrees. All have bachelor's degrees and science and math backgrounds which were prerequisites for the program. The program was competitive. A third of the

[Continued to page 4]

Women engineers

(Continued from page 1)

applicants were not accepted because of inadequate qualifications.

Cherry attributes the women's hesitancy to "too much emphasis on fulfillment without corresponding attention to reality, the kind of information — what jobs are available and how do I prepare for them — which men have been geared into from the time they were very young.

"The fact is that 90 per cent of all women will work at some time in their life, many of them for a great part of it. It's not a frivolous activity. It's a serious business," Cherry said.

Nevertheless, the women do see another educational venture as a risk. Some of the women are still paying off educational loans and have not found positions which give them financial security. Although their tuition will be covered by the NSF grant, some will have to find part-time jobs while they are at UD. "Naturally, they wonder if it's going to be worthwhile, if there's going to be a payoff," Cherry said.

The program, especially designed for women past the undergraduate age, will take a year-and-a-half to complete. Students will choose between programs in chemical or electrical engineering.

UD was one of three universities receiving the NSF grants. The others were the University of California at Davis and the University of Notre Dame. Shaw had directed the Women in Engineering programs held for the past three summers on the UD campus. She also has a $9,940 grant from NSF for a weekend workshop in February for women from Ohio colleges.

Shaw is convinced of the women's eventual success. The demand is there. The women need only fill it. "In 1974, women comprised 1.6 per cent of the engineering graduates, 20 per cent of the chemistry graduates, 8 per cent of the physics graduates and 41 per cent of the mathematics graduates," she said. "This historic pattern of few women engineering graduates combined with the current demand for engineers provides an excellent opportunity for those women interested in an engineering career."

Patricia Rooney

UNITED WAY MESSAGE

Employes found out where and for what their dollars were going during last week's United Way campaign. One of the speakers was Dick Frans who had a few words about the Boy Scounts of America, one of the larger United Fund organizations.

BENEFITS BRIEFS

Q. What benefits do I receive if I am on a Maternity Leave of Absence?

A. All benefits remain in force until the termination of the leave. When you deliver, we pay maternity benefits plus nursery charges.

Q. What happens if I or one of my dependents is confined for mental illness and after confinement need treatment by a psychiatrist?

A. Full Plan benefits are payable just as for any other illness while in the hospital. Out of hospital treatment by a psychiatrist is paid at 50% unless it is the employe and he is not working, and then 80%.

LEAGUE NEEDS COORDINATOR

The Mound Basketball League needs a coordinator to run things during the 1976-77 season. Any employe interested in being the coordinator, or finding out more about the job should contact Bill Blevins, ext. 3381, or Barry Reed, ext. 3549. The league needs a volunteer as soon as possible so the coming season can be planned. Without a volunteer, the league will have to be cancelled.

IRAD TENNIS

By winning all 4 points against DESC in the final team match of the season, the Mound Netters won the IRAD Tennis League with a record of 33 wins and 7 losses. The loss dropped DESC to 3rd place in the final standings and enabled the Monsanto Dayton Lab Team to finish in 2nd place. Other teams competing in the League were Miami Valley Hospital, Dayton Progress, Monarch Marking, Standard Register and Dayton Power and Light.

Members of Mound's Championship team were Elton Murphy, Don Hastings, Fran Haas, Bob Ellis, Dick Neff, Dan Hill, Seukwon Pai, Jerry Barnett and Ray Anderson.

Carol →

WOMEN ENGINEERS?

Don't laugh, there's a big demand for women engineers today. In fact, there are many women entering the field because it offers them strong career possibilities. Not only that, but professional women engineers are good at their jobs.

The University of Dayton has come up with a program to help women into the engineering track in what they call their FAST-TRACK LATE ENTRY PROGRAM. What the program does is to take holders of bachelors degrees in certain fields and advance them to the current level of engineering graduates. The reasons for doing this are many, but top among the reasons is that the engineering field offers higher salaries and greater advancement possibilities than some other scientific fields.

The field is open, too. Women who have received a Bachelor's or Master's degree in chemistry, mathematics, physics or a related field between 1961 and 1974 are eligible. In the FAST-TRACK program there's no tuition cost, since the National Science Foundation is footing the educational cost of women who qualify.

Need we say more? Perhaps, but if you want the real scoop, see Barbara Bonelli in Personnel.

UNCLASSIFIEDS

ADVERTISING POLICY

Only Mound employes may use the newsletter advertising service. Advertising must be submitted to Communications, A-144, by Friday for inclusion in the following Thursday's edition. Ads will be published for two consecutive weeks and must be re-submitted for further publication. All transactions resulting from the ad service must take place outside scheduled working hours.

— FOR SALE —

Aluminum storm door, used but in good condition; two windows and two screens, needs hardware. $10. Barry Reed, 435-9238. 9/17/76

Anyone interested in subscribing to CONSUMER REPORTS at the group rate of $8 per year, call Howard Kreider (3309) or 433-7417. 9/17/76

Whirlpool No Frost 12' refrigerator/freezer – excellent condition. $125.00. and Sears Coldspot 8000 BTU Air Conditioner. Window mount, 120V, excellent condition. $100.00. Bill Yates (7189) 1-641-3467. 9/17/76

1972 Vega Hatchback, 3 speed, low mileage. (3128) or 274-2974 after 5. 8/31/76

Maple trundle beds with innerspring mattresses, bunkie boards and springs. F. N. Bradley, 748-1054. 9/24/76

'75 Honda 400 - Super Sport, dark blue, still under warranty (only 2 months old). Only 1700 miles (fully serviced at 1000). No problems. Assume payments. Ext. 3597 or 298-7187 after 5 p.m. 9/24/76

DINING ROOM SUITE, Duncan Phyfe, Blond Mahogany Finish. Table - 64" X 42" plus automatic leaf of 12", Chairs - 1 captain and 5 regular, Tulip Design. Buffet - 62" long X 19½" deep X 35½" high. Reasonable offer. John L. Kuhn, 746-8234 or ext. 3169. 9/24/76

WANTED

Playmate(s) for three year old daughter. Will consider cooperative play-group or part-time babysitting in our home. S. Linden-Maue Rd. area in Miamisburg. Call my wife (859-8436) Bill Tonne. 9/24/76

Cotton & Knot scraps suitable for making quilts. Please call 3453 or 866-7061, Ollie Johnson. 9/17/76

In engineering

NSF backs women

The University has received a grant of $111,944 from the National Science Foundation for the implementation of a one-year, late-entry program for women who are interested in careers in chemical or electrical engineering.

Designed for women who earned undergraduate degrees in math, chemistry and physics between 1961 and 1974 and would like to respond to the current demand for women in engineering, the program will begin in January, 1977. The grant will be used to sponsor scholarships for the approximately 40 women who will enroll. Tentative deadline for application is Oct. 30.

Students will be enrolled full time in one of the two paths which will lead to a bachelor's degree either in chemical or electrical engineering. Women with math, science, chemistry or commensurate backgrounds are being sought, according to Carol M. Shaw (chemical engineering technology), coordinator of the program, because their academic background is similar to that of professional engineers. "The demand is there," she explains. "In 1974 women comprised 1.6 per cent of the engineering market, twenty per cent of the chemistry market, eight per cent of the physics market and 41 per cent of the mathematics market. The historic pattern of few women engineering graduates together with the current demand for engineers provides an excellent opportunity for those women interested in an engineering career."

The program will begin with a week-long session aimed at psychological motivation and re-enforcement of the participant's decision to obtain credentials as a professional engineer. Panel discussions will focus on problems encountered by professional women in contemporary society. Women with experience as professional engineers will be available for role model identification.

Shaw also prepared another proposal for a $9,940 grant, also approved by the National Science Foundation, for a weekend workshop slated in February when women from Ohio colleges will be presented with the options available to them in science and engineering. UD was the only one of 33 institutions to receive a grant for both the year long re-entry program and the workshop. Program design, realizable objectives and UD's previous experience of recruiting women and minorities were cited as reasons for the approval of the grant.

UD has been involved in a previous

[Continued on page 2]

Women engineers

[Continued from page 1]

project with the Monsanto Corp. to retrain their personnel to become qualified chemical engineers. Shaw also has directed the Women in Engineering programs held for the past three summers on the UD campus. The workshops enabled high school age women to investigate the possibility of careers in engineering.

"Of course," said Shaw, "the test of all our programs is whether the people we educate can function as professional engineers. We have acquired enough experience in adult education and re-training to gain an insight into what education is needed for professional competence."

(P.R.)

DESC Electron, Vol. XIII, No. 16

Defense Electronics Supply Center

February 18, 1977

STUDENTS ORIENTED — Officials of the DESC Directorate of Engineering Standardization and Office of Civilian Personnel discuss career opportunities in Federal service for six visiting representatives of the University of Dayton's Fast-Track Late Entry Program. Answering questions on the Center's engineering program and general prospects within the Federal service are: (l-r) George Miller, chief of the Electro-Mechanical Division; Engineering Standardization deputy director Robert Radeloff; Civilian Personnel director Carlos Clifton; and Air Force Col. Floyd Heinzig, director of Engineering Standardization.

DESC Supporting Program To Interest Women In Engr.

DESC and the University of Dayton are participating in a special National Science Foundation-sponsored program to interest women who have degrees in other fields with a career in engineering.

The Center recently conducted an orientation on DESC operations for six students participating in the program and this month hired on a temporary basis its first participant under the program.

The so-called Fast-Track Late Entry Program is intended to advance holders of bachelor's degrees in mathematics, chemistry, physics or a related science to the current academic level of engineering graduates. With the NSF sponsorship, there is no instructional cost to the participants.

Women participating in the program attend regular classes at UD and are offered the opportunity to work on a temporary basis in engineering functions such as the Directorate of Engineering Standardization at DESC.

ACCORDING to University of Dayton officials, engineering has predominantly been a male profession but currently the doors are opening to women. This is a desirable turn of events because of the top job and salary offers for both chemical and electrical engineers and the keen competition for employment in the field of mathematics where women comprise a large percentage of graduates.

Currently, the demand for women engineers exceeds the supply. In 1974, women engineering graduates represented only 1.6 of the total engineering graduates. In comparison, they represented 20 per cent of the chemistry grads, 8 per cent of the physics graduates and 41 per cent of the mathematics graduates.

The program is accepting any woman who has received a bachelor's or master's degree in chemistry, mathematics, physics or a related field and who has graduated between 1961-1974. Those accepted into the Fast-Track Late Entry plan attend UD on a full-time basis for 11-1/2 months. Area businesses and agencies such as DESC have been notified of the program and asked to support the effort. This coming October, a job fair is scheduled with firms and government units to help place the students.

UD OFFICIALS also indicated that those who complete the program will receive academic credit for courses taken as well as a certificate describing the academic nature of the program. The course of study will also prepare participants for graduate work in chemical and electrical engineering providing they meet the normal entrance requirements.

Non-academic expenses such as room and board are absorbed by the students themselves.

DESC's participation in the program is intended to acquaint students with employment opportunities in Government with hopes that they will consider a Federal career once they complete the program.

OCT 3 - 1978

university of dayton

news release

27 WOMEN MAKE JOURNEY TO
FORTUNE 500 LIST IN ONE YEAR

DAYTON, Ohio, September 29, 1978 --- From limited career options at the lower end of the salary scale to bids from Fortune 500 companies is a long way to travel in one year.

Making the journey successfully were 27 women from the University of Dayton who graduated in January of 1978 from one of the first one-year programs to train women to become professional engineers.

The prototype program will be repeated; a second grant from the National Science Foundation for $178,000 will allow the tuition-paid program to be offered again, beginning in January of 1979. Living stipends also will be available.

The success story of UD's Fast-Track I is validated by Joan Callanan, NSF program director for the Women in Science project, who said, "UD's Fast-Track program is one of the more successful in terms of placing its graduates."

A typical success story is Jane Brauer, 26, a sales engineer with Reliance Electric Co. in Pittsburgh. A year-and-a-half ago, she was a high school math teacher in Illinois. "The brochure must have come in the mail on a bad day with my geometry classes. In four weeks I had to make my decision, leave a secure position where I knew there was a check coming in, close my house, store my furniture, and drive to Dayton. After six weeks in the program I was convinced that I had made the right decision. It was the academic stimulus that did it, plus forming good study habits again and being exposed to people working in the field, people who could show me how wide the path could be."

-more-

Information Services/Richard T. Ferguson, director/University of Dayton/Dayton, Ohio 45469/(513) 229-3241

In her job as a salesperson Brauer works with the steel and coal industries. Despite some conservative attitudes in what are largely male dominated fields, Brauer believes she is proving herself to be as competent as any of her colleagues.

"At first being a woman can be an advantage. Purchasing agents are anxious to see what a woman engineer looks like. But after that initial meeting, they expect me to do as good a job as a man, maybe even better."

Preparation for such trials began as soon as the women were in the Fast-Track program, according to Carol M. Shaw, assistant dean of Engineering for Special Programs and Continuing Education at UD. The initial one-week session of the program is devoted to motivation and counseling in preparation for the work of the ensuing year. Included in that week is a diagnosis of skill attainment; a sequence of math courses are available to those whose lack of background in this area might prove a hindrance in the program. The sequence was evidently a success; those Fast-Track students who took courses with undergraduates were judged to be among some of the most qualified their instructors had ever had in the classroom.

A professional development course helped participants over those first hurdles of resume writing and the job interview. Nancy Cook Cherry, career education program manager for the Fast Track program, believes that learning to capitalize on previous successes is an important part of that exercise. "Making it more difficult was the fact that those successes were often in areas in which the students did not want to return for employment. For instance, Jane Brauer had never worked in sales, yet, those interviewers who asked her about her inexperience, heard that she had indeed worked in sales; for five days a week, she had sold geometry to 11th grade students."

-more-

Most startling of the success stories are of those whose salaries increased drastically. Christina Perri, 28, was on welfare before entering Fast Track I. Today, she is earning a salary in the high teens and has even greater potential as she is in General Electric's management training program. The time, the rigorous study -- four or five hours a night -- and the struggle to support a small child were all worth it.

Perri describes herself as one of those whomen who were "intelligent but not career minded. In 1968, when I was a college freshman, engineering was out of the question; besides, overcoming the resistance of males in the math department was hard enough. I figured engineering could only be worse. But, you change your mind pretty quick when you have a small child to raise."

The job fair, which was held during Fast Track I, was another key to the women's success, particularly the dinner afterward, according to Cherry, when the company recruiters became fully aware of the program's credibility through the efforts of the Fast Track staff. "The women who interviewed for jobs had only to sell themselves. By that time, the employers were already sold on the program," Cherry said.

Giving support to the women's decision to enter the Fast Track program was an important part of the professional development course. Marie Bushong, who is in her mid-40s, had already been told by peers that she was too old to change careers. They reminded her that she had already arrived at a moderate level of comfort as an editor for Chemical Abstracts in Columbus.

Nevertheless, she and her two teenaged children moved to Dayton for the one year of the program. The risk was worth the effort; Bushong received some of the highest paying job offers of anyone in the program. Today, she is in the international division of Proctor and Gamble with responsibilities which take her to all parts of the world while maintaining a home base in Cincinnati.

Full academic credit is awarded for all courses taken in the Fast-Track program. Options are available in either chemical or electrical engineering. Qualified candidates must have bachelors or masters degrees in math, chemistry, or physics.

The program also satisfies all of the UD School of Engineering requirements for a second degree. Award of a second degree does depend, however, upon satisfying general University requirements. All students who complete a minimum of 30 credit hours in the Fast-Track program are awarded a certificate describing the academic nature of the program. There are an average of 35 credit hours in the Fast-Track curriculum.

Next year's students will attend the program full-time from January to December 14, 1979, and take 12 hours of courses in each of three terms: January 16 to April 27; May 3 to July 27; and August 27 to December 14. Self-paced instruction as well as traditional lectures will comprise the courses. Those interested in applying for the program should contact Shaw at the University of Dayton. Her telephone number is 513-229-2736.

Women being recruited into engineering program

Women are being sought at UD to participate in a one-year, tuition-paid program to become electrical or chemical engineers.

Qualified women must have bachelor's or master's degrees in mathematics, chemistry, or physics. Program participants will be limited to approximately fifty. Stipends for living expenses are available.

The program begins January 8, 1979. The application deadline is October 10.

The program, Fast-Track II, will be entirely supported by a $178,000 grant from the National Science Foundation. This is the second time that NSF has funded such a program at UD.

"UD is offering Fast Track II because of the tremendous success of the prototype program, Fast-Track I, offered in 1976-1977 at UD," said Carol M. Shaw, assistant dean of Engineering for Special Programs and Continuing Education and project director for the program.

"Women completing Fast-Track I were eagerly sought by industries across the country," she continued. "A number of women were offered management training programs with Fortune 500 companies. Several women had up to seven job offers and received salaries that were $10,000 greater than what they had previously earned."

The program, since it is a prototype, is in the process of being duplicated by another University at the suggestion of an industry in that area which competed unsuccessfully for graduates of UD's Fast-Track program, according to Shaw.

"UD's Fast-Track program is one of the more successful in terms of placing its graduates of the twenty programs funded by NSF," said Joan Callinan, program director for NSF's Women in Science project. NSF has funded programs for women in chemistry, computer sicence, and interdisciplinary studies.

A special feature of the program is an initial one-week session devoted to motivation and counseling in preparation for the work of the ensuing year. A professional development course will be offered to support the participants' self-concepts as professional engineers.

Full academic credit will be awarded for all courses taken in the Fast-Track program. Options are available in either chemical or electrical engineering. The program also satisfies all of the School of Engineering requirements for a second degree.

Award of a second degree will depend, however, upon satisfying general University requirements. All students who complete a minimum of 30 credit hours in the Fast-Track Late Entry program will be awarded a certificate describing the academic nature of the program. There are an average 35 credit hours in the Fast-Track curriculum.

Students will attend the program full-time from January to December 14, 1979, and take 12 hours of courses in each of three terms: January 16 to April 27; May 3 to July 27; and August 27 to December 14. Self-paced instruction as well as traditional lectures will comprise the courses.

TREND NOTES

University of Dayton is reportedly seeking women with science or computer-science backgrounds to participate in a one-year, tuition-paid program to become electrical or chemical engineers. Information on the program can be obtained from Carol Shaw, Assistant Dean of Engineering, University of Dayton, Dayton, Ohio 45469.

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DAYTON DAILY NEWS

FALL, 1978

UD to offer program for women engineers

Women interested in becoming electrical or chemical engineers will have a chance to qualify for such a degree in a special program now being organized at the University of Dayton.

Carol Shaw, assistant dean of engineering for special programs and continuing education, said that up to 50 women are being sought for a one-year, tuition-paid program known as Fast-Track II. Ms. Shaw said that qualified women must have bachelor's or master's degrees in mathematics, chemistry or physics.

The program starts Jan. 8, 1979, but application deadline is Oct. 10.

Shaw said that UD is offering Fast-Track II, which is financed by a $178,000 grant from the National Science Foundation, because of the success of the protype, Fast-Track I.

"Women completing Fast-Track I," Shaw said, "were eagerly sought by industries across the country. A number of women were offered management training programs with Fortune 500 companies. Several women had up to seven job offers and received salaries that were $10,000 greater than what they had previously earned."

Shaw said a feature of the program is an initial one-week session devoted to motivation, diagnosis and counseling. A professional development course will be offered to support the participants' self concepts as professional engineers.

Award of a second degree will depend upon satisfying general university requirements.

Students will attend the program full time from January to Dec. 14 and take 12 hours of courses in each of three terms.

Persons interested should contact Shaw at the University of Dayton, Dayton 45469 or by calling 229-2736.

SCIENCE NEWS

FALL, 1978

Tuition-free degree

OCT 12 1978

The University of Dayton is offering a tuition-free educational program to train women for careers in chemical and electrical engineering. The year-long, 35-credit-hour course is available to women who completed bachelor's or master's degrees in mathematics, chemistry or physics between 1950 and 1977. Women completing the course will have fulfilled all the technical requirements of the university's engineering-degree program and will receive a certificate explaining their training. If their previous course work fulfills other university degree requirements, the women will be eligible for an engineering degree at no additional cost. Counseling, tutoring, a refresher course in math and some living stipends are among support services offered entrants. Applications will be accepted through October 10 for the program beginning January 8; interested persons should contact Carol Shaw, assistant dean of engineering. □

AMERICAN SOCIETY FOR ENGINEERING EDUCATION

ENGINEERING EDUCATION NEWS

NOVEMBER, 1978 VOL. 5, NO. 5

Free Tuition for Women

The University of Dayton offers a tuition-free educational program designed for women who want to enter the field of engineering. The program is funded by NSF for women who have earned bachelor's or master's degrees in mathematics, chemistry or physics between 1950 and 1977 and want to redirect their careers into chemical or electrical engineering. The program is called Fast-Track II. Those who complete the course work will have fulfilled all the technical requirements for the university's engineering degree program and will receive a certificate explaining their training. If their previous experience fulfills other university requirements, the women enrolled in this program may also earn an engineering degree from the University of Dayton. For more information on the program, contact Carol M. Shaw, Assistant Dean of Engineering for Special Programs and Continuing Education, Univ. of Dayton, Dayton, OH 45469.

DAYTON DAILY NEWS

APRIL 16, 1979

'It just seems like a lot of work now, but it will be worth it'

UD helps students engineer 4 years of work into one

By D.J. HILL
Daily News Staff Writer

Forsaking all others until death us do part . . .

The University of Dayton doesn't force women in its accelerated engineering program to take a vow to the death, but for one intensive year the women say they sometimes feel they're in a bond they can't break.

They come from all over the nation to enroll in the Fast-Track program, where they cram into one year four years worth of engineering training toward a degree.

THEY INCLUDE women like Linda Pollack, 31, who couldn't resist the bait — a chance to get an engineering degree tuition-free.

She talked her husband, Ron, into the idea. And together they locked up their house in Pittsburgh, Pa., packed their 1 and 2-year-old children into the car and headed for Dayton.

Pollack, taking a year's leave of absence from his high school chemistry teaching job, became the housekeeper, chief cook and bottle washer. Meanwhile, his wife became a workaholic, pushing more than 60 hours of study into a week in addition to 15 hours of classes and untold other hours into school-related activities.

"Everything's scheduled now," Mrs. Pollack said. "I have to do everything by schedule now, because I always have homework waiting and a test tomorrow."

Is it worth it?

"I THINK IN the end it will be worth it," Mrs. Pollack said. "I don't think we fully yet have any idea what we've gotten ourselves into now. It just seems like a lot of work now. But it will be worth it. At least, I hope so."

Indeed it will be worth it, said Dean Carol M. Shaw, Fast-Track coordinator. In the first Fast-Track class in 1977, 27 of the 31 students enrolled in the course finished, she said.

And for every woman who graduated, there were about three job offers waiting from the likes of General Electric, IBM and the Mead Corp.

One of the finishers from the first class, Jane Braurer, agreed the "intense" work and "hectic" pace were worth it.

"It gave me an opportunity to do something I hadn't thought about doing or that probably would have taken me several years if I had just gone to night school," said Brauer, a sales engineer in the Pittsburgh office of Reliance Electric Co., a Cleveland-based firm.

RIGHT NOW, the 39 women in the program can look no farther than the next day's homework assignment.

Karen Harrahill, 23, graduated with honors in math and psychology before she returned to Nebraska Wesleyan to pick up enough hours for additional undergraduate degrees in biology and chemistry.

"When I was in college, I studied maybe 15 hours a week, and I had plenty of time to work and do things I liked," said Harrahill, "If someone had told me I'd ever be studying 60 hours a week, I would have told them they were crazy."

Barbara Barrett, 45, of Centerville, said, "It's always so demanding. The teacher usually is discussing one chapter in class, you're doing homework on another chapter and you're being tested on still a third chapter. Everything moves too fast for them all to be synchronized."

"IF YOU MISS one night of homework, you've had it," said Miss Harrahill, "Usually you have a day between classes so you have a day to make it up. Here you're in classes five days a week, everyday. You have something for every night and more on weekends."

In Fast-Track, the women can get degrees in chemical or electrical engineering. They get all the engineering courses a regular undergraduate student in the discipline would have to take, but they don't have to take the out-of-discipline and related subjects other undergraduates have to study. The women have gotten the background all ready.

But why engineering now and not when they originally attended college?

Mrs. Barrett, mother of a Dartmouth University senior and a chemistry teacher at Centerville Middle School, said a woman engineer was unheard of when she graduated from college in 1955.

"I had a tough enough time being a woman chemistry major. That was considered a brave new world at that time," said Mrs. Barrett.

NOW, WHEN companies are begging for engineers and are anxious to hire women to help fulfill their affirmative action goals, Fast-Track is right on target, Shaw said.

Since starting the program, representatives from about 25 colleges around the nation have come to observe Fast-Track, Shaw said.

Since 1973, UD had offered special career programs for women and the Engineering Department had been working on the idea of the accelerated engineering program. When the National Science Foundation announced in 1975 that it would give money to institutions with suitable career planning projects for women, UD was able to get its idea together quickly and present it. It beat out many schools who later filed for the funds.

The foundation provides $112,000 a year to pay tuition for the women and give those who need it funds toward a year's living expenses.

"If the brochure had said two years (instead of one for the program), I would have had to think about it a little longer. A year I can sacrifice," said Mrs. Pollack, who receives financial aid in addition to her tuition costs.

B 25

Update on Fast Track

From limited career options at the lower end of the salary scale to bids from Fortune 500 companies is a long way to travel in one year.

Making the journey successfully were 27 women from the University of Dayton who graduated in January of 1978 from one of the first one-year programs to train women to become professional engineers.

The prototype program is being repeated; a second grant from the National Science Foundation for $178,000 is allowing the tuition-paid program to be offered again, with living stipends also available.

The success story of UD's Fast-Track I is validated by Joan Callanan, NSF program director for the Women in Science project, who said, "UD's Fast-Track program is one of the more successful in terms of placing its graduates."

A typical success story is Jane Brauer, 26, a sales engineer with Reliance Electric Co. in Pittsburgh. A year-and-a-half ago, she was a high school math teacher in Illinois. "The brochure must have come in the mail on a bad day with my geometry classes. In four weeks I had to make my decision, leave a secure position where I knew there was a check coming in, close my house, store my furniture, and drive to Dayton. After six weeks in the program I was convinced that I had made the right decision. It was the academic stimulus that did it, plus forming good study habits again and being exposed to people working in the field, people who could show me how wide the path could be."

In her job as a salesperson Brauer works with the steel and coal industries. Despite some conservative attitudes in what are largely male dominated fields, Brauer believes she is proving herself to be as competent as any of her colleagues.

"At first being a woman can be an advantage. Purchasing agents are anxious to see what a woman engineer looks like. But after that initial meeting, they expect me to do as good a job as a man, maybe even better."

Preparation for such trials began as soon as the women were in the Fast-Track program, according to Carol M. Shaw, assistant dean of Engineering for Special Programs and Continuing Education at UD. The initial one-week session of the program is devoted to motivation and counseling in preparation for the work of the ensuing year. Included in that week is a diagnosis of skill attainment; a sequence of math courses are available to those whose lack of background in this area might prove a hindrance in the program. The sequence was evidently a success; those Fast-Track students who took courses with undergraduates were judged to be among some of the most qualified their instructors had ever had in the classroom.

A professional development course helped participants over those first hurdles of resume writing and the job interview. Nancy Cook Cherry, career education program manager for the Fast Track program, believes that learning to capitalize on previous successes is an important part of that exercise. "Making it more difficult was the fact that those successes were often in areas in which the students did not want to return for employment. For instance, Jane Brauer had never worked in sales, yet, those interviewers who asked her about her experience heard that she had indeed worked in sales; for five days a week, she had sold geometry to 11th grade students."

Full academic credit is awarded for all courses taken in the Fast-Track program. Options are available in either chemical or electrical engineering. Qualified candidates must have bachelors or masters degrees in math, chemistry, or physics.

The program also satisfies all of the UD School of Engineering requirements for a second degree. Award of a second degree does depend, however, upon satisfying general University requirements. All students who complete a minimum of 30 credit hours in the Fast-Track program are awarded a certificate describing the academic nature of the program. There are an average of 35 credit hours in the Fast-Track curriculum.

Next year's students will attend the program full-time from January to December 14, 1979, and take 12 hours of courses in each of three terms: January 16 to April 27; May 3 to July 27; and August 27 to December 14. Self-paced instruction as well as traditional lectures will comprise the courses. Those interested in applying for the program should contact Carol Shaw at the University of Dayton, Dayton, Ohio. Tel: (513) 229-2736.

COLUMBUS DISPATCH

MARCH 31, 1980

Wanted: Women Engineers

By Mary Ann Edwards
Of The Dispatch Staff

Life & Times

If you had a daughter who showed real aptitude for mathematics and the sciences, what sort of career would you encourage her to investigate?

Chances are you would tell her about teaching chemistry or biology or arithmetic. Or you might advise her to study computer science.

CHANCES ARE good you would NOT think of suggesting a career in one of the many branches of engineering.

But Marianne Mueller, P.E., is trying to change all that. She wants daughters of all ages with an interest in science and math to consider engineering — AND to consider pursuing the program at Ohio State University.

Mrs. Mueller, director of women's programs for the OSU College of Engineering, seems proud of that "P.E." after her name. And well she should be. It stands for "professional engineer" and means she has worked in the field of engineering for a certain number of years and has passed a test given by the state board of registration for professional engineers.

SHE CITES statistics which indicate that only 2.8 percent of the working force of engineers in 1977 and 1978 were women. Certainly this sounds as if a female engineer is someone special.

But Mrs. Mueller doesn't like the "special" status that comes with being a woman engineer, because she feels this attitude puts female engineers on pedestals.

"I'm an engineer who happens to be a woman and not a woman engineer," she says.

NEVERTHELESS, Mrs. Mueller's position exists just because women in engineering and considering the field do need some special treatment. When engineering has as many women as other fields, then her job can be eliminated, she notes.

"But so far they need special support and encouragement," she says. "Engineering is still a male-dominated field, but that doesn't mean the work cannot be done by females."

In fact, she adds, "Companies are fighting for women engineers!"

While opportunities for women are rising in engineering, they are declining in many female-oriented fields, such as teaching, Mrs. Mueller points out.

THE AVERAGE starting salary for an engineering graduate is $19,000 per year, and the typical senior, especially female, can rattle off five or six job offers before graduating, OSU officials say.

While OSU has had someone performing her duties since the early 1970s, only Mrs. Mueller and her immediate predecessor, Edith Korda, P.E., have had the job as a full-time task.

OSU's recent recruiting efforts must be paying off. In 1972, only 1 percent to 2 percent of the college's engineering students were female. Today the number is 13 percent and Mrs. Mueller's goal is for 25 percent of the fall 1980 freshmen engineering students to be women.

THE ENGINEERING College has a speaking society which sends members out to high schools to recruit students for the program. Each panel always includes women, who offer special help to girls thinking of an engineering career.

"Engineering is still so male-oriented . . . that many of the women don't even think about going into engineering," Mrs. Mueller, who took over her job last October, says.

She invites high school girls to spend a day on campus. Each one is paired with a woman engineering student, who takes the girl along to classes, introduces her to faculty members and shows her around the campus. If the girl is from out of town, she can spend the night in one of OSU's dormitories, too.

Besides undergraduates, OSU also is interested in women with the same background but who originally chose other careers.

"WE WOULD like to attract more women who have a degree already," Mrs. Mueller says. "They are unemployed or underemployed."

Such women may have discovered they cannot use their degrees or they may have dropped out of their previous occupations for family reasons. Perhaps they are teachers who are out of work in a crowded field.

A survey by the National Science Foundation showed that there are about half a million women in the United States who would fit into this category, she continues.

The University of Dayton currently has a special engineering program, called Fast Track, aimed at these returning students. The program is sponsored by the foundation and the industry, Mrs. Mueller says.

BEFORE SUCH a program can be launched at OSU, the university needs to find out how much interest there is in the community, she says. At first, it might be geared to teachers on vacation in the summer or it might be handled by the existing continuing education department.

Mrs. Mueller says there are probably 24 to 50 such women in the Engineering College today.

While the demand for women engineers is big and the salary is good, a woman in the field still must be able to handle a certain number of problems which result from being both young and female in an industry dominated by men.

A SURVEY by the Scientific Manpower Commission showed starting salaries for female engineers are 4 percent higher than for men, Mrs. Mueller notes. However, the same survey shows that in every field of engineering, except for the starting pay, women's salaries are lower.

A woman still may find some difficulty in being accepted by male coworkers.

Young engineers have more knowledge of computer science and recent advances in the field than older coworkers, she explains. This can create ill feelings toward the young men and especially the young women who are new on the job.

"A YOUNG graduate woman engi-

APR 10 1980

MON., MAR. 31, 1980 F Columbus Dispatch C-7

TALKING IT OVER — Marianne Mueller, left, director of women's programs for the Ohio State University College of Engineering, talks with two OSU engineering students after a morning recruiting session at South High School. They are Joanne James of Akron, center, who is majoring in mechanical engineering, and Mary Thomas of 198 E. Norwich Ave., a junior in metallurgical.

neer has to prove herself capable, not only as an employee but as an engineer," Mrs. Mueller says, and she probably has to work harder to prove herself than a man would, especially in the construction industry, which is not yet used to dealing with women.

Then there are the problems that all career women face.

"Every professional woman has a problem combining career and family life," says Mrs. Mueller, who has two daughters, Julie 23; and Lisa, 15. "One has to make compromises . . . it is hard to be a perfect career woman and housewife at the same time."

But, she adds, "There can be a balance."

SHE POINTS out that a 1977 survey by the Society of Women Engineers showed that of the female engineers working in the field, more than 50 percent were married, while 38 percent were single. The rest were divorced or widowed.

The director, who is in her 40s, says engineering offers a chance for creativity and a chance to see the direct results of one's work. And it is a career upon which a woman always can depend.

"It gives a secure and independent feeling," she says.

Before coming to OSU, Mrs. Mueller was a structural engineer, designing bridges for the Franklin County Engineering Department. She received her training at the Technical University of Budapest, Hungary.

SHE WORKED for various consulting engineering firms, based in New York and Chicago, and she had the job of designing many of the bridges on the Columbus I-270 (Outerbelt).

She and her husband, Ivan, have lived in the Columbus area about 20 years. He is an OSU professor of geodetic science, which deals with the shape of the Earth for purposes of surveying.

Now both U.S. citizens, they fled Hungary shortly after a revolution against the Soviet regime there in 1956 was crushed by the Russians.

APPENDIX C

OUTLINES OF MOTIVATIONAL WEEK

SCHEDULE OF ACTIVITIES

MOTIVATIONAL AND DIAGNOSTIC WEEK

January 17, 1977	University Holiday - Martin Luther King Day
January 18, 1977	
9:30 a.m. - 10:00 a.m.	Welcoming - Kennedy Union, Room 311-312 Professor Carol M. Shaw Dr. David C. Kraft, Dean School of Engineering
10:00 a.m. - 11:15 a.m.	Panel Discussion - Kennedy Union, Room 311-312 Dorothy Bowers Merck & Company "From Chemistry to Chemical Engineering" Japnell Braun, Ph.D. Monsanto Mound Laboratories "Late Entry into Graduate Work: A Unique Challenge" Lelia McAdams Armco Steel Corporation "A Family and Career: The Ultimate Challenge" Anne Newman General Electric Company "Engineering Career Development at Mid-Thirties"
11:30 a.m. - 12:15 p.m.	Faculty Panel Discussion: What is the Nature of Chemical and Electrical Engineering?
12:15 p.m. - 1:30 p.m.	Luncheon - Fast-Track Students, Late Entry Panel, and Faculty
2:00 p.m. - 4:00 p.m.	Roundtable Discussions with Industry Representatives - Engineering Building, Room 212-281
January 19, 1977	
9:00 a.m. - 11:00 a.m.	Advanced Mathematics Placement Test Engineering Building, Room 264

SCHEDULE OF ACTIVITIES (Continued)

MOTIVATIONAL AND DIAGNOSTIC WEEK

11:30 a.m. -	Tour of Campus - Leave from front of Engineering Building
1:00 p.m. - 5:00 p.m.	Career Management Training Program. Consultants in "Social Engineering Technology" from Los Angeles, California, will conduct these sessions - Engineering Building, Room 212-281

January 20, 1977

10:00 a.m. - 12:00 noon	Career Management Training Program Continued - Engineering Building, Room 212-281
12:00 noon - 1:30 p.m.	Faculty Luncheon with Career Consultants. Kennedy Union - Room 253. (Fast-Track Students are on their own.)
1:30 p.m. - 5:30 p.m.	Career Management Training Program Continued - Engineering Building, Room 212-281

January 21, 1977

8:30 a.m. - 9:30 a.m.	Validation of Student ID's - Pictures Taken. Engineering Building, Room 264.
9:30 a.m. - 5:00 p.m.	Individual Consultation with Mathematics, Chemical and/or Electrical Faculty

Registration may take place anytime during the week of January 18-21, 1977 in Room 201 of the Engineering Building.

SCHEDULE OF ACTIVITIES

MOTIVATIONAL AND DIAGNOSTIC WEEK

January 8, 1979

9:30 a.m. - 10:00 a.m.*	Coffee and Doughnuts Kennedy Union, Outside Rooms 311-312
10:00 a.m. - 11:00 a.m.	Introduction and Overview Kennedy Union, Room 311-312 Dean Carol M. Shaw and Mrs. Nancy Cook Cherry
11:15 a.m. - 11:30 a.m.	Coffee Break
11:30 a.m. - 1:00 p.m.	Industry Panel - Employment Opportunities in Industry: What is Industry Looking for in Technical and Non Technical Skills? Career Paths of Successful Women in Industry Kennedy Union, Room 311-312
1:15 p.m. - 2:00 p.m.	Lunch - Kennedy Union, Room 253 Sponsored by the School of Engineering
2:00 p.m. - 3:45 p.m.	Testing - Kennedy Union, Room 310 For research on adult women reentering school
4:00 p.m. - 5:30 p.m.	Tour of Town - Bus will leave from Kettering Lab at 4 p.m. and provide transportation to TGI Friday's restaurant
5:30 -	Dinner at TGI Friday's Reasonably priced meal at one of the areas "in" restaurants - Dutch Treat includes a 15% gratuity. Bus will return to campus after dinner - approximately 8:00 p.m.

January 9, 1979

9:00 a.m. - 11:00 a.m.	Faculty Panel - "What Do Chemical and Electrical Engineers Do?" - Kennedy Union, Room 311-312
11:00 a.m. - 1:00 p.m.*	Lunch break on your own
1:00 p.m. - 3:00 p.m.*	Individual Consultation with Mathematics, Chemical and/or Electrical Faculty
3:00 p.m. - 4:00 p.m.	Tour of Campus - Meet in lobby of Kettering Lab (Engineering Building)

January 10, 1979

9:00 a.m. - 5:00 p.m.	Professional Development Workshop Dr. Adele Scheele and Mrs. Nancy Cook Cherry Kettering Lab, Room 281
Lunch break on your own	
6:00 p.m. - 11:00 p.m.	Open swim at the Physical Activities Center

January 11, 1979

9:00 a.m. - 5:00 p.m.	Professional Development Workshop Dr. Adele Scheele and Mrs. Nancy Cook Cherry Kettering Lab, Room 281
Lunch break on your own	
5:30 p.m. - 7:00 p.m.	Wine Social - Kennedy Union, Room 250 Informal meeting with faculty

January 12, 1979

9:00 a.m. - 11:15 a.m. *	Fast-Track I Panel - Kettering Lab, Room 281
11:30 a.m. - 1:00 p.m. *	Lunch - Kennedy Union, Room 250 Sponsored by the School of Engineering Dr. Jay D. Pinson, Speaker
1:00 p.m. - 4:30 p.m. *	ID Pictures Taken - Kettering Lab, Room 281 Individual Consultation with Mathematics, Chemical and/or Electrical Faculty Registration - Dean Carol M. Shaw Kettering Lab, Room 201 Appointments for registration with Dean Carol M. Shaw for individuals not scheduled on Friday will be set up to be held the following week by Mrs. Pignatiello, Kettering Lab, Room 201.
4:30 p.m. *	Pick up evaluation form from Mrs. Pignatiello, Kettering Lab, Room 201. Form must be completed immediately and returned to Mrs. Pignatiello.

* Revisions to Tentative Outline of Schedule of Activities for Motivational and Diagnostic Week

APPENDIX D

CURRICULUM EVALUATIONS

MATHEMATICS REPORT

The following is a report on the mathematics portion of the second seven-week portion of "Operation Fast Track".

Background: Since approximately one-half of the students had some form of a differential equations course as an undergraduate, a proficiency course was offered to anyone who desired to bypass the course. (See Encl. 1). Of the 4 who took the proficiency exam, 3 passed. In passing, and in retrospect, more students should have been strongly urged (if not forced) to make an efort to take and pass the proficiency exam. Certainly, more could have passed if a serious effort had been made.

Course Outline: The preliminary outline (See Encl. 2) shows that the refresher was a standard applied differential equations course with emphasis on problem solving. The course was divided into four major divisions: First order equations; Linear equations; Applications of Laplace transforms; and the use of infinite series processes. A review of infinite series was included since it was not a part of the calculus refresher.

Text: The text used was "Applied Analysis for Physicists and Engineers" by B. J. Rice. Essentially, the material of Chapters 2, 3, 4, and 5 were covered with some omissions. The amount of material covered and omissions made were similar to that occasioned in similar courses taught in differential equations in the past.

Testing: (See Encls. 3-7) Four tests were conducted approximately one hour each and a final comprehensive exam of two hours concluded the course. The scores generally averaged in the "B" range.

Problem Session: Initially no special arrangements were made for problems sessions, but about half-way through a helper was supplied for 4-5 students in difficulty. Further, the instructor of the course was available quite often in the study room.

Teaching Methodology: No noticeable change in teaching this particular course was made as opposed to the way it is conducted in the normal undergraduate setting.

Group Reaction: The group reaction to this course was not as positive as for the previous seven-week refresher even though the same instructor was involved. Some possible reasons for this are as follows: (a) Certain members of the group felt strongly that they should not be made to take the differential equations course. Indeed, they were probably correct in their judgement and a stronger effort to bypass the course by taking the comprehensive exam should have been made.

(b) Some of the negative reaction was undoubtedly due to the simple attrition of goodwill as additional pressure mounted on the students.

Comparison to Expectation: To the instructor, the students certainly met, and in some way even surpassed, their anticipated goals. This was particularly true of some of those in the chemical track who had weaker backgrounds and little or no prior exposure to differential equations.

Final Grades: (See Encl. 9) The final letter grade was determined from the quizzes and the final exam. The final grades show that of the 26 people taking the course, the grades were as follows: A: 13, B: 6, C: 6, D: 1. In addition, one student audited the course and three received credit by examination.

I. SUMMARY

The Electrical Engineering Track in the Fast-Track Late Entry Programs was designed to extend the capabilities of holders of bachelors' degrees in mathematics or the hard sciences into the electrical engineering area. The goal was to provide sufficient additional academic training so that the participants would become attractive prospects for employment in professional-level positions of the kind offered to new graduates of electrical engineering programs.

Although the FT-I program plan did not include enough course work for a second bachelor's degree, there was sufficient upper level work to satisfy the residence requirement, and it was expected that most participants would be motivated to complete the B.E.E. degree on a part-time basis as transient students at universities near their places of employment.

The FT-II program was expanded to bring the participants closer to the B.E.E. degree.

The selection process yielded a group of individuals possessing in common a high level of scholastic maturity. All had learned how to learn in their first degree program. All were accustomed to dealing with abstractions and the process of building a discipline upon an axiomatic foundation. Most had achieved more learning in the humanistic-social area than the usual engineering student.

The transformation to electrical engineering started from this base. The process included:

1. Development of familiarity with the language, objects, and topics of engineering, particularly electrical engineering.
2. Development of proficiency in constructing mathematical models representing circuits, devices, systems, and signals.
3. Gaining practice in basic engineering analysis and design.
4. Learning experimental techniques through laboratory work.
5. Becoming familiar with what electrical engineers do and what is expected of them.

FT-I

All 18 participants who started the electrical-track portion of the program completed it; 17 are now employed in engineering positions; several have completed the Bachelor of Electrical Engineering degree, and all are actively working toward that end. The individual not employed in an engineering position has completed the B.E.E. degree and is currently working on a master's degree.

In FT-II, 20 of 21 starting participants successfully completed the program. All but one or two received the B.E.E. degree at the end of the program; and, all have now completed the degree. The group was well accepted by industry and several have made outstanding achievements.

II. THE CHALLENGES/THE STUDENTS

The major challenge was to make optimum use of the high potential of each participant. Teaching methods would need to include some degree of individual attention at the beginning of the program to interface the diverse scholastic experience with the techniques of engineering education. The inherent, existing talent of each student should be channeled with maximum effectiveness. The methods should minimize the chances of introducing frustration, insecurity, or doubt.

Curriculum and time limitations required a careful selection of courses to insure that the participants would acquire knowledge and training of sufficient depth and breadth to begin practice in an engineering position; or, in some cases, to [illegible] enter a graduate engineering program as well. Gaps would certainly exist, but well chosen course material could provide a basis for sufficient extrapolation to bridge small gaps through self-learning.

The responsibility of the program to the students was not to be taken lightly since each individual would be making a real sacrifice and would be investing essentially a year in participating. Fortunately, for FT-I, there was some scattered but significant data from departmental experience with mathematics majors who had transferred into electrical engineering at a well advanced stage, or who had undertaken a second bachelor's degree program

in electrical engineering. In all such cases the outcome was successful; the students completed the B.E.E. degree and experienced no difficulty in assuming professional practice. There was reasonable assurance, then, that a properly designed curriculum could meet the expectations of the FT-I participants. The demonstrated success of FT-I removed most of the apprehensions regarding FT-II program design. Improvements were based upon the experience gained in FT-I.

That the participants were all women was never viewed as a challenge in regard to designing the engineering courses. That the participants were all mature individuals who had previously completed a bachelor's program and had started some form of career was seen as a serious challenge. The instructional techniques would need to reflect strong recognition of such maturity and experience because these positive factors could be used to advantage in significantly improving instructional effectiveness.

III. THE INSTRUCTIONAL CONCEPT

The traditional four-year electrical engineering program, aside from the english composition and humanistic-social content, features a basic science and mathematics foundation, a core of engineering science courses, and a series of electrical engineering courses that cover design or synthesis as well as analysis. Laboratory courses are included to teach techniques of experimentation.

The analysis portion of electrical engineering, as encountered in both electrical engineering-science courses and electrical engineering courses, is predominately applied mathematics. Electrical systems are analyzed by developing a mathematical model which through mathematical manipulation produces solutions that predict the behavior of the electrical system.

The model is generally a differential equation, although vector analysis, linear algebra and matrices, operational calculus, complex number analysis, orthogonal function concepts, and probability and statistics are often brought into play in dealing with advanced systems.

In effect, the electrical engineering student becomes somewhat of an applied mathematician over the four-year program. Unfortunately, the mathematical learning must be accomplished concurrently with the study of electrical phenomena; and, at first, only the very simple electrical devices and systems can be discussed. The students at that time do not have the scholastic maturity to appreciate the concept, value, and power of mathematical modeling. They must mark time until the mathematical tools are more fully developed before they can handle the really challenging work. Only much later do the students discover that the earlier analysis was merely a simple special case of a more general theory.

How much more efficient and effective the learning program could be if the student were initially proficient in higher mathematics, were able to deal with abstraction, and appreciated the concept of developing a

discipline from an axiomatic foundation. Mathematical modeling would be understood quickly and the student could begin the study of electrical engineering-science and electrical engineering by working with general systems.

This line of thinking is the basis for the term fast-track as applied to the current program. By starting with a group of students having a strong mathematical background, it should be possible to avoid much of the normally unavoidable delay in reaching the essence of electrical engineering analysis. Motivated students with such qualifications should be able to complete in one year what normally might require two.

FT-I

The instructional concept used in the electrical track may be summarized by the following set of guidelines:

1. Use a transitional approach. Convince the students that they already know how to solve the mathematical models of linear electric circuits. Instil confidence at the outset.

2. Stress that electrical engineering-science consists of disciplines constructed from axiomatic foundations. Mathematicians know exactly what that means, and their confidence will be reinforced even more.

3. Work quickly into mathematical modeling. Maximum use of isomorphisms will assist this process.

4. Prepare detailed hand-out material: descriptions and outlines of courses, lists of general and specific course objectives, recommended learning procedures, study guides, resource material including bibliographies, and the like. Electrical engineering textbooks for the critical initial courses are not addressed to students of this kind, and are certainly not designed around the teaching strategy required in this program.

Special bridging and interpretative material will have to be written for at least the first course or so.

5. Treat the students as the mature, highly motivated individuals that they are. Explain the planned instructional strategy thoroughly to them and enlist their cooperation in the learning effort. Expect them to accept a measure of responsibility for making the plan work.

6. Employ some form of personalized or individualized instruction in those first courses where the students have their most trying moments. Because of their diverse scholastic backgrounds and post scholastic experiences, each one will undergo a different pattern of adjustment to finally reach the common level envisioned by the program design. Self-paced instruction seems an ideal vehicle for this purpose; the lock-step pressures of conventional instruction are eliminated and a mature individual is free to apply full concentration on learning and personal gap-filling, and the instructor tends in this kind of course to become more aware of the student as an individual.

7. Generally, all courses should clearly highlight what is fundamental in that particular area, and there should be considerable development of simple basic examples, capable of being extrapolated. Every minute must count if the transformation of the students is to be completed in the short time available; the instructional materials and techniques should be designed to implement subsequent self-development.

The instructional concept did not change in the FT-II program; however, it was discovered in FT-I that the first academic term was sufficient for achieving the desired transition. Additional points were added:

8. At the end of the first academic term the participants should begin integration with the traditional students. It is important that the FT students discover for themselves their current level of achievement and proficiency. Experience shows that they can easily compete with , or even out-do, the traditional students at this point. This is a positive reinforcing factor which builds confidence and improves the efficiency of the remainder of the program.
9. Integration should be complete during the last term. Students should be in regular upper-level courses with the traditional four-year students.

IV. CURRICULUM DESIGN

Prior to the actual selection of the participants the proposed curriculum design was based on direct departmental experience with various groups of individuals having related needs.

1. Prerequisite specification for individuals with a B. Sc. in physics or mathematics who then obtained a master's degree in electrical engineering.

2. Program specification for individuals with a bachelor's degree in physics, mathematics, or engineering technology who then obtained a second bachelor's degree in electrical engineering.

3. Program and course design for individuals in the existing Late Entry, Bachelor of Engineering Program conducted by the University of Dayton for mature persons working full-time in engineering-related fields and who wish to complete a bachelor's degree in engineering.

The composition of the proposed curriculum included support courses in mathematics, fortran programming, and strength of materials. Electrical engineering topics (courses) were as follows:

Circuit analysis
Electrical devices
Passive and active circuit analysis and design
Engineering electronics
Energy conversion
Communication engineering
Digital systems
Automatic control

Laboratory in circuits, instrumentation,
and electronics
Laboratory in digital electronics,
communication subsystems, and control

In F-T I

All of the electrical engineering courses were ~~in~~ new, specially designed courses. Because of support limitations, the engineering electromagnetics discipline was not included as a specific course; however, a minimum presentation was to be included in the electrical devices course and the energy conversion course.

The curriculum design jelled quickly after student applications were reviewed and it was seen that the group consisted of individuals with high scholastic ability and performance. All were from the mathematics or hard sciences areas; none were from engineering technology; accordingly, it became feasible to proceed with the instructional concept.

Further support limitations made it necessary to delete fortran programming and strength of materials from the program. The department did, however, agree to subsidize the addition of a course in engineering electromagnetics for the students in the electrical track and a basic electric theory course for the students in the chemical track.

The primary reason for adding the latter upper-level courses was to enable the Fast Track Late Entry Program to satisfy the University residence requirement. In this way the program would not be a terminal effort, but would become an open-ended program facilitating the achievement of a bachelor's degree in a specific engineering area. All the students in the electrical track chose to view the Fast-Track Program as a second degree program; an official, formal evaluation and specification of remaining requirements for the B.E.E. degree was prepared for each student, and each one was accepted as a Second Degree student in the Electrical Engineering Program at the University of Dayton.

A second, but equally important, reason for adding the engineering electromagnetics course was to respond to the unusually high mathematical proficiency of the electrical-track applicants. The course was not originally proposed because the initially expected mathematical level of the participants (the group might have included bachelor of technology graduates) could not have been sufficiently improved during the program to introduce an engineering-grade course involving field theory. The inclusion of the electromagnetics course now provided a Fast-Track Program that covered all the basic electrical engineering disciplines.

In FT-II, the first term with its transitional approach was maintained, a laboratory course was added to introduce hands-on experience earlier, and a special condensed mechanics/dynamics course was added to better satisfy accreditation requirements. The second and third term material coverage was expanded again to satisfy accreditation requirements but also to bring the participants closer to the B.E.E. degree during their tenure in the program. (A standard thermodynamics course, CME 305, 3 credit hours was added; also, a microprocessor workshop was included). The greatest variation in the second and third terms was the shift to regular upper level electrical engineering courses and complete integration with traditional four-year students.

V. IMPLEMENTATION

In FT-1

The total program was distributed over six terms and included an extended break after the third. The schedule was as follows:

Term One: 7 Weeks

Special Topics in Mathematics	3 Semester Hours
Circuit Analysis	2 Semester Hours

Term Two: 7 Weeks

Applied Differential Equations	3 Semester Hours
Electrical Devices	2 Semester Hours

Term Three: 5 Weeks

Active and Passive Circuits	3 Semester Hours

Semester Break: 5 Weeks

Term Four: 5 Weeks

Engineering Electronics	3 Semester Hours

Term Five: 7 Weeks

Energy Conversion	2 Semester Hours
Communication Engineering	2 Semester Hours
Laboratory I	1 Semester Hour

Term Six: 7 Weeks

Digital Systems	2 Semester Hours
Automatic Control	2 Semester Hours
Laboratory II	1 Semester Hour

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Engineering Electromagnetics, a 4 Semester Hour course, was conducted under a directed studies format and distributed over Terms Two, Three, and Four.

The most critical course in the program was, perhaps, the first electrical engineering-science course. It was here that the planned instructional method was first applied. The nature of the course and details of its implementation are best illustrated by the description and outline distributed to the students; this information is reproduced in full below.

****

DESCRIPTION AND OUTLINE OF COURSE

ELE 499 SPECIAL PROBLEMS IN CIRCUIT ANALYSIS 2 CREDIT HOURS

I. INTRODUCTION

The analysis of linear electric circuits is approached from the achieved mathematical competence of a student with a bachelor's degree in mathematics or a hard science. The course is transitional in that it begins with material and logical procedures very familiar to the student and in a measured way develops familiarity with first the language and techniques of electrical engineering science and subsequently the language and art of electrical engineering.

Circuit analysis is of course an open ended discipline. Depending on the individual specialty, all electrical engineers need not have the same depth of knowledge in this area, although a certain minimum competence would be expected. The objective is to develop at least the foundation for this minimum competence during the course and to set the way for fully achieving such a level as follow-on courses are completed.

The stress is always on building confidence in the student by pointing out the clear and logical route from her present competence to the distant reaches of the discipline, so that any required level of competence can be achieved in the future by the process of self-learning.

A personalized system of instruction will be used in the course to insure that the learning starts from the individual's present knowledge and that progress is matched to the inherent talent of the student. Competition with one's self is encouraged.

II. INSTRUCTIONAL OBJECTIVES

When the course is completed the student should be able:

1. To formulate mathematical models of linear circuits containing R, L, and C elements and driven by sources of arbitrary types.

2. To utilize mathematical models to analyze circuit types commonly encountered in engineering practice, some having initial conditions.
3. To employ methods of operational calculus to simplify the analysis of steady state sinusoidal circuits and transient circuits.
4. To communicate with engineers in matters relating to electric circuit analysis.

These are broad objectives pertaining to the entire course. More specific and detailed objectives will be stated for each of the various course modules.

III. RESOURCE MATERIALS

Hayt and Kemmerly, ENGINEERING CIRCUIT ANALYSIS, McGraw-Hill, 1971 is the specified textbook for the course. Its contents will be used on a selective basis throughout this and other courses in the program.

Edminister, ELECTRIC CIRCUITS, Schaum's Outline Series, McGraw-Hill (paperback) is a highly recommended supplement and source for detailed solutions of many varieties of circuit problems.

A Study Guide developed for this course will define the subject matter for each unit, why it is important, what the student is expected to learn in that unit, and how to go about learning it. Assignment of specific readings in the textbook, problem assignments, special learning modules, and other resource materials are part of the Study Guide.

An abundance of electric circuits books will be available in the University Library and the department. Important also, for motivational purposes, are the IEEE professional journals and transactions and other professional quality serial publications, all located in the Library.

IV. COURSE TOPICS

1. TRANSITION
   a. Examination and review of the linear constant coefficient ordinary differential equation and the initial value problem.
   b. The L C C O D E as a mathematical model for linear electric circuits via the axiomatic foundation of circuit theory.
   c. Example and practice solutions.

COMMENT: This starts the student on familiar ground. Realization by the individual that the mechanics of the solution of sophisticated circuit problems is already part of her competence should inspire confidence. An axiomatic approach to a discipline is a concept well understood and appreciated by mathematicians and by students of the hard sciences. This takes full advantage of their previous training and facilitates maximum speed of development of the new discipline; i. e., the "fast-track" concept.

2. FAMILIARIZATION:- A MORE FORMAL APPROACH TO THE AXIOMATIC FOUNDATION OF CIRCUIT THEORY
   a. Electric circuit variables: charge, voltage, current, power, energy, time.
   b. Circuit parameters: R, L, and C, experimental laws, power and energy.
   c. Sources.
   d. Conventions.
   e. Fundamental principles.

Reading assignments are in Chapters 1, 2, and 4 of the textbook.

COMMENT: This begins the process of familiarization with the language of electrical engineering science and the physical variables and constants that will replace the symbols in the abstract mathematical expressions. The student will see that the electrical engineering science of circuit analysis grows logically from a very concise, easily remembered foundation. It is not at all necessary at this time that the student fully appreciates the physical significance of R, L, and C; that aspect will be addressed in the second course..

3. STEADY STATE VERSUS TRANSIENT

   a. Practice in modeling and solving circuits commonly found in engineering practice; differential equation methods used.

   b. Association of mathematical results with the actual physical behavior of real-world circuits.

   Reading assignments are in Chapters 5, 6 and 7 of the text book.

COMMENT: Familiarization with the language of electrical engineering science continues, some electrical engineering art is introduced and the student is beginning to do things that she can recognize as being useful.

4. STEADY STATE SINUSOIDAL CIRCUITS AND FOURIER CONCEPTS

   a. An operational calculus to simplify the solution of circuits driven by steady state sinusoidal sources.

   b. Phasors and complex impedance

   c. General methods of network analysis

   d. Network theorems

   e. Power and energy

   f. Power factor, resonance

   g. Polyphase circuits

   h. Extension to nonsinusoidal periodic excitation via Fourier concepts

   Reading assignments are in Chapters 8 through 12 and Chapter 17 of the text book.

COMMENT: This is the used-every-day part of the electrical engineer's stock of circuit theory knowledge. Again, the treatment starts from mathematical topics already familiar to the student and continues to introduce the language and art of electrical engineering.

5. RESISTIVE CIRCUITS

   a. Analysis of circuits containing no energy storage elements

   b. Resistive networks containing dc sources

   c. Reading assignments are in Chapter 2 and 3 of the text book.

COMMENT: This part of circuit analysis is typically the starting point in traditional courses because students can handle it before they have learned the more difficult mathematical formalism needed to gain real understanding of the general circuit. In this course the process is reversed. Here important properties peculiar to electric circuits are highlighted and summarized effectively by using a format stripped of mathematical complexity.

6. COMPLEX FREQUENCY AND LAPLACE TRANSFORM METHODS
   a. An operational calculus to simplify the solution of transient circuits
   b. Poles and zeros
   c. Frequency response of networks

   Reading assignments are in Chapters 13, 14 and 19 of the text book.

COMMENT: Now that there is some familiarity with electric circuit theory as such, a powerful and general mathematical modeling technique is introduced in anticipation of its further application in subsequent courses. Again, the mathematical concepts themselves will be already familiar or easily understood by the group of students for whom the course is designed.

V. CONDUCT OF COURSE

No attempt is made to attach a firm time frame to the six topics because a self-paced approach will be used in this first course. The topics will be surveyed approximately a week apart with more time being devoted to topic 4, otherwise the meetings will be fairly informal, the instructor answering questions, working example problems, and concentrating on individual guidance. The students will be expected to follow the detailed instructions of the study guide and should be ready with questions for the instructor.

There will be no group examinations, this is not consistent with self-paced learning; instead, each student is tested as she completes a particular unit, and satisfactory comprehension is required before the next unit is attempted.

The first two courses in the program are designed so that the slower students can accomplish the remainder of the first course in parallel with the second course, if it becomes necessary. Again, each student is matched against

herself; it is not at all necessary for everyone to achieve the same level of competence in this area so long as a certain minimum level is attained.

Practice in solving circuit problems is vital to learning circuit analysis and gaining familiarity with engineering terminology, conventions, techniques, and the art. Problem assignments, collected and reviewed, will be part of the evaluation process.

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The remaining 10 electrical engineering courses are described below by the introduction section of each course outline and description. The material has been taken verbatim from the original documents.

ELECTRICAL DEVICES

A participant in this course possesses a bachelor's degree in mathematics or in a hard science and has been taking a course in electrical circuit analysis where the instructional strategy is that of exploiting the isomorphism that exists between the linear constant coefficient ordinary differential equation (including the initial value problem) and the mathematical model of the linear electric circuit. The former is familiar ground to the student and it becomes possible to effect a rapid transition to at least the mechanics of circuit analysis. (Basis for the "fast-track" concept.)

The previous course included familiarization at the electrical engineering science level and to some degree at the electrical engineering level so that the student gradually has become able to associate the R, L, and C elements in mathematical models of linear electric circuits with the idealized physical entities the elements represent. What is necessary now is to develop a first-hand qualitative and quantitative familiarity with the numerous real-world devices that are modeled by R, L, and C idealizations.

The present course stresses electrical engineering rather than electrical engineering science and covers not only the theory but also the design and application of physical electrical devices. This includes energy and power handling capability, practical limitations, safety, reliability, engineering specifications, and standards. The circuit analysis techniques learned in the previous course will be reinforced through application, and a certain amount of field theory will be introduced.

PASSIVE AND ACTIVE CIRCUITS

A participant in this course has previously completed an introductory course in circuit analysis, and one in electrical devices. Both of these courses tended toward the transitional, and thus did not come to grips with those aspects of circuit theory generally associated with design and/or synthesis. It is assumed that the skills of the student have been sufficiently developed to accommodate the more pragmatic aspects of the discipline, leading to a grasp of the breadth of its application in various electrical engineering areas.

The stress will be on a dual perception of the significance of those applied mathematical techniques generally presented, in a traditional electrical engineering curriculum, in a circuit-theory setting. First, the capability for analysis must be seen to result in a capability for synthesis, regarding linear passive networks. Then, the applications to networks containing active elements, electronic circuit design, communication, and automatic control must be established.

ENGINEERING ELECTRONICS

Engineering Electronics is one of the first electrical engineering courses in the program. (Previous courses in circuit theory have been electrical engineering-science courses.) A new dimension in thinking is called into play; engineering analysis and art must be added to scientific analysis. One must deal here with approximate or incomplete information, with circuit components that cannot, individually, be characterized by exact parameter values, with transcendental equations that defy analytical solution, with design problems that can have more than one acceptable solution, with a confusing but very necessary array of symbols, and with designs that are strongly influenced by economic, environmental, reliability and maintainability, and manufacturing considerations.

In electronics, the student will find that techniques in engineering analysis (and design) often involve what initially seem to be nonconventional approaches to problem solving (such as graphical solutions and iterative methods). The student must learn to make reasonable approximations, strategic simplifications or idealizations, to supply missing information, and to apply common sense and, perhaps, a little intuition at times--a process sometimes called, "making engineering judgments."

In this course we are primarily interested in learning how to use electronic devices to accomplish various engineering objectives. Amplification, signal generation, contactless switching, signal conditioning, impedance matching, rectification, pulse regeneration, filtering, signal addition, frequency translation, parametric energy conversion, parameter synthesis, and information processing and storage are a few of the many individual objectives that are integrated to help make possible our modern communication, control, energy conversion, computing, and instrumentation and measuring systems.

Fortunately, it is possible to use physically complex electron devices without understanding how they work, just as it is possible to expertly use a calculator, a computer, or a motor vehicle without really knowing how they work. The trick in electronics is to become well acquainted with the techniques of using terminal characteristics to determine large scale non-linear behavior by graphical methods, and to generate conceptual, equivalent linear device models (or equivalent circuits) to determine small signal behavior.

The course focuses on the ideas and the nature of electronics. If these are clearly understood it is relatively easy to extrapolate such learning to modern electronic circuits and systems where more than a tinker-toy competence is required to do significant engineering development. Some of the basic topics are:

1. Graphical representation of terminal characteristics of nonlinear devices.
2. The amplification concept, and graphical solution of low frequency, large signal amplifiers.
3. The concept of bias.
4. Device limitations, specifications, practical aspects.
5. Sensitivity analysis.
6. Low frequency small signal linear amplifiers via the model or equivalent circuit concept.
7. Small signal linear amplifier configurations.
8. Active circuits, parameter synthesis.
9. High frequency, small signal linear amplifiers.
10. Feedback, and applications to electronic circuits and systems.
11. Integrated circuits.
12. Electronic systems.

ENERGY CONVERSION

Energy conversion is one of the last electrical engineering courses in ~~the~~ a program. It is perhaps, somewhat far removed from the electrical engineering science courses because it draws heavily upon subject material included in the broader engineering science courses and applies this subject material to practical concepts and problems found in energy conversion. For example, material drawn from these areas include:

1. Circuit Theory (including transient, steady state and polyphase analysis)
2. Field Theory (including, in particular, vector and non-linear analysis of magnetic fields)
3. Dynamics (with emphasis on torque, polar moment of inertia, mechanical power, work and energy)
4. Basic Vector Analysis
5. Mathematics through differential equations (with some knowledge of the Laplace transform)

Energy conversion theory may be bounded by simple models to the concept of a vector representation of an instantaneous magnetic field derived from line integrals which produce a field that is revolving at a constant angular velocity. The theory, being electromagnetic, naturally gives rise to a new

and not unfamiliar phenomena namely non-linearity of the magnetic system being analyzed. The interaction of these non-linear magnetic fields coupled with the requirement for a fair degree of accuracy for problem solutions immediately present the students with varying degrees of challenge. The student must, therefore, quickly learn to utilize the basic concepts outlined above toward solving problems of a dynamic and non-linear nature which further require the ability to solve such problems within fairly narrow limits of accuracy. Wherever possible, economic, manufacturing, environmental and production concepts are strongly emphasized to support certain conclusions.

COMMUNICATION ENGINEERING

Communication Engineering is a broad field encompassing many phases of electrical engineering. It deals with the transmission of an information bearing signal from an originating location to a destination location. In many cases the nature of the signal to be transmitted is such that the transmission medium -the channel- cannot efficiently support it. In such cases it is usually possible to match the properties of the signal to the properties of the channel by appropriately processing the original signal before it is transmitted. The signal is then reprocessed at the destination location to recover the original signal. The type of processing which is usually performed at the originating location is called modulation; the type of processing usually performed at the destination location is called demodulation.

This course will be primarily devoted to a study of the properties of the three most frequently encountered forms of modulation and demodulation: amplitude modulation, angle modulation, and pulse modulation. In addition, some representative electronic circuits which can be used to modulate and to demodulate signals will be discussed. A more detailed coverage of this aspect of communications is obtained in courses in circuit analysis and synthesis and in electronic circuits. Coverage of the properties of communication channels such as transmission lines, wave guides, and electromagnetic radiation is obtained in courses in electromagnetic field theory.

LABORATORY I

This course involves the student in experimental situations stressing both familiarization with and the development of competence in electrical engineering experimental technique including instrumentation. At this stage the student will have completed courses in network analysis and electronic circuits, and will be able to make quantitative theoretical predictions of the outcome of experiments.

DIGITAL SYSTEMS

A digital system is a system whose physical quantities, such as voltage or current, take on only discrete values. Some examples of digital systems are: numerically controlled machine tools, the pulse code modulation (PCM) system of transmitting information, the electronic switching system used by the telephone company, some subsystems of modern oscilloscopes, digital voltmeters, calculators, and computers.

The design of a digital system can be considered to be composed of three inter-related major steps: (1) System design which consists of specifying the function of the system and of determining the major components required to accomplish the specified function; (2) Circuit design which consists of the detailed design of the circuits which will be used as the building blocks of the system; (3) Logic design which consists of determining how to interconnect the building blocks to accomplish the desired function of the system economically. This course will be primarily devoted to a study of the logic design phase.

AUTOMATIC CONTROL

A participant in this course has previously completed studies of electrical devices and networks, Fourier and Laplace transforms, and communication theory. The concepts of network synthesis are relatively familiar, resulting in an appreciation of the necessity to design to specifications given in terms of either the temporal response or the frequency response of a system.

The thrust in this course will be to translate this recently-acquired background into an understanding of the techniques generally associated with "conventional" (as opposed to "modern") automatic control theory and practice. Emphasis will be placed on the development of skills required for performance in a first job assignment involving the treatment of an automatic control system.

LABORATORY II

This course is a continuation of learning activity in electrical engineering experimentation. The topics covered deal primarily with electronic subsystems, but the instructional interpretation is broad enough to include some of the many components associated with such subsystems.

The student, at this point in time, will have completed courses in network analysis, electronics, communication engineering, and energy conversion; and, is concurrently learning automatic control and digital systems.

ENGINEERING ELECTROMAGNETICS

Electric and magnetic fields, electric and magnetic forces, energy storage, magnetic circuit theory and design, dielectric and magnetic materials, capacitor and inductor design, conductors and semiconductors, electrodynamics, and introduction to Maxwell's equations. Vector calculus is the mathematical tool developed and used throughout the course.

In FT-II the total program was distributed over three regular academic terms. The first term was split in that the same transitional electrical engineering courses used in FT-I could be employed. (Mathematics courses were dropped because the participant selection process insured adequate preparation.) The schedule was as follows:

TERM I: 14 Weeks

Circuit Analysis	2 Sem. Hrs.	(7 weeks)
Electrical Devices	2 Sem. Hrs.	(7 weeks)
Field Theory	3 Sem. Hrs.	(14 weeks)
Circuit & Instruments Lab	1 Sem. Hr.	(7 weeks)
Mechanics/Dynamics	3 Sem. Hrs.	(14 weeks)

TERM II: 12 Weeks

ELE 312 Engineering Electronics	3 Sem. Hrs.
ELE 332 Circuit Theory IV	3 Sem. Hrs.
CME 305 Thermodynamics	3 Sem. Hrs.
ELE 499 Electonic Systems Lab	1 Sem. Hr.

OPTION: Either of the Following

ELE 431 Energy Conversion	3 Sem. Hrs.
ELE 334 Field Theory III	3 Sem. Hrs.

TERM III: 15 Weeks

ELE 413 Communication Engineering	3 Sem. Hrs.
ELE 432 Automatic Control Systems	3 Sem. Hrs.
ELE 531 Digital Systems Theory	3 Sem. Hrs.
ELE 499 Electrical Systems Lab	1 Sem. Hr.

Additional course work included a Professional Development Course and a Microprocessor Workshop. The curriculum also provided time to satisfy other requirements for a Bachelor of Electrical Engineering Degree.

VI. PERCEPTION OF DEGREE OF SUCCESS

The most desirable outcome of any program is success; it is appropriate, then, to comment on what the planners of the electrical track perceive to be the degree of success achieved by that portion of the Fast-Track Program.

Success may have a number of meanings, depending on who defines it. Here, the interested parties are mainly: (1) the students in the program, (2) the sponsors of the program, (3) the program director, (4) the planners and implementers of the electrical-track portion of the program, and (5) the users of the products of the program. The criteria might be as follows:

1. Students: The participants hope to have their careers transformed; they hope to become immediately employable in positions comparable to those offered to new graduates of bachelor degree programs in electrical engineering. The income of a participant should increase drastically, and the way should be opened to growth limited only by the motivation and drive of the individual: a realistic possibility for a degree in engineering, professional registration, the full technical or managerial ladder available to the engineer.

2. Sponsors: The program should expedite increasing the fraction of professional engineers who are women.

3. Planners: There should be evidence that the instructional concept works.

4. Users: Personnel who are products of the program should become productive after completing whatever indocrination, orientation or initial internship training is normally given to new bachelor degree graduates of engineering programs.

The degree to which all these criteria are satisfied is becoming evident as time passes. The collective experience of the group of participants is a good test of the effectiveness of the program. Meanwhile, there are various factors which might be viewed as predictors of a positive outcome: These are listed below.

1. Of the 39 participants who started the electrical track, all but one successfully completed the program. This is an indication of a correct initial evaluation of applicants and of the participants' drive and determination to succeed.
2. All 38 successful participants chose to make formal application for admission as Second-Degree students. Specific program requirements for the Bachelor of Electrical Engineering degree were established for each individual, and all completed the 30 credit-hour residence requirement.
3. Approximately one-third of the participants completed part of the additional academic requirements for the BEE degree during the first Fast Track Program, and virtually all FT-II participants completed the B.E.E. degree during the program.
4. Most of the FT-I participants have arranged for the approval of courses to be taken on a transient basis at colleges and universities in the vicinity of their places of employment.

5. Twelve FT-I participants and all FT-II participants have, in fact, completed the B.E.E. degree. Three or four additional individuals are known to be near completion, possibly at the end of another semester.

6. A number of the participants worked in engineering-related jobs on a part-time basis during the Fast-Track Program. (Placement in these jobs was arranged through the offices of the Program Director as part of a financial aid service.) The students functioned well: an indication of their ability to adapt effectively to a new career.

7. Virtually all the students eagerly and agressively interviewed with many prospective employers near the termination of the Fast-Track Program. This is a good indicator of a high level of confidence brought about by their training. (Much of the credit for their confidence is due to training in the career orientation service courses and sessions developed by the Program Director.)

8. There was a continuing high level of interest in the students by the many company recruiters, with follow-up interviews and plant visits; an indication that these trained recruiters sensed the developing competence of the participants. Eventually all but one of the students were placed in engineering positions. The one exception is possibly the most technically competent individual in the group, but her status as an alien creates difficulties.

9. The earning power of all the employed students increased sharply. Many have doubled their income in their new positions, and previously unemployed individuals readily found employment on the basis of new qualifications and competence developed in the Fast-Track Program.

10. The scholastic performance of Fast-Track students was compared to that of the regular undergraduate students by means of a common comprehensive test. The test covered circuits, electronics, energy conversion, communication engineering, digital systems, and automatic control. The performance of the Fast-Track students easily matched that of the regular electrical engineering students.

11. The Fast-Track students adapted rapidly to experimental work in the laboratory courses. Several groups did outstanding work, clearly superior to that of the average electrical engineering students working on the same experimental topics. An open lab format was used and many of the participants developed such an interest in the work that they accomplished more experimental work than was required. Lab reports and notebooks were neater, more thorough, better organized, more clearly written, and more professional than those of any of the regular students. This completely unexpected result probably reflects maturity, higher motivation and interest, training in the first bachelor's

degree, and experience in the various areas of employment before undertaking the change in career.

12. Some of the Fast Track students have successfully passed the National Engineer in Training (E.I.T.) examination, a first step toward professional registration.
13. Some have made remarkable achievements as engineers and have become valuable resource persons for motivating students in new Fast Track programs. One example: A former high school teacher and a mother of two children who in one-year after the FT-II program became a senior engineerin radio-frequency design of communication satellite systems.

VII. CONCLUSIONS, RECOMMENDATIONS

In comparing the outcome of the program with the loosely defined criteria of success, one can identify a number of facts, observations and results indicating that the concept of "fast-tracking" works.

From the point of view of the students, many have had their careers transformed. They are now working in areas of engineering, have satisfying, challenging positions with growth potential; and have a substantially increased income.

From the point of view of the sponsors, an avenue has been indicated for rapid entry into engineering of interested members of a large group of women who are already partially qualified through mathematical competence gained in a previous degree program.

Fast-tracking is accomplished by making full use of several qualities of the selected participants: (1) an achieved competence in higher mathematics, (2) scholastic and personal maturity, and (3) a strong motivation to change careers. Initial concentration must be on effecting a transition---at a high level---from abstract mathematics to applied mathematics of the kind used in modeling electrical phenomena; ideally, linear circuits. The axiomatic nature of the electrical engineering-

science disciplines conforms well to the thought processes of such individuals and they are soon solving, mechanically, very sophisticated problems. A familiarization program, carefully, perhaps subtly, introduced then brings the students to the happy realization that they have already reached a significant level of competence in electrical engineering analysis. With confidence in their existing ability maintained, and confidence in their ability to handle a new discipline established, the students are now receptive to a logical, connected extension of these foundations into the engineering analysis and design courses of a general electrical engineering program.

From the point of view of the electrical-track designers and implementers, there is enough evidence to indicate that this concept is workable.

Experience with the Fast-Track Program and the participants gives rise to a series of concluding observations, some of which may be taken as recommendations:

1. The first courses in the electrical-track portion of the program must be specially designed in regard to both content and manner of implementation. Adapting existing courses in the typical electrical engineering curriculum will waste time by underutilizing the mathematical capability of the students. For example, within two weeks after starting the first electrical-track course the participants were successfully analyzing electrical transients in multimesh networks by using differential equation methods. Even though they could not at first relate to physical sources and physical R, L, and C components, they had no difficulty in handling the symbolic circuit models, Kirchhoff's laws, and ideal R, L, and C parameter response expressions, all on a definition and axiomatic basis. They were able to deal with initial condition determination and utilization. It was interesting to note that the students worked equally well with voltage sources and current sources, whereas the regular electrical engineering student often has difficulty with the current source concept because of bias developed through prior experience.

2. A detailed study guide should be provided for at least the first critical courses because the conventional textbooks are not written for this kind of student. Carefully selected textbooks should be specified, but these must be extensively interpreted and supplemented by the study guide. The course designer should review all the specified resource material, the learning instructions, and the assignments through the eyes of a student.

3. The first two electrical-track courses were operated in a special self-paced format. A detailed study guide provided complete instructions of what the student was supposed to learn (and why), and how to go about learning it. All problem assignments and other student responsibilities were specified completely. Classes were held every day, but these were very informal question and answer sessions and concentrated on problem solving and discussion of conceptual difficulties.

Testing was done on an individual basis (not during class time) whenever the student felt prepared to take a test on the particular unit. This individualized instructional method provided the flexibility needed to accommodate the diversity in scholastic backgrounds of the entering students and to bring them all to a common threshold level. Individualized testing, some of it oral, provided the close contact between the instructor and each student that made the instructor aware of the specific learning needs of everyone.

4. Because of the short time available, it is important in all courses to concentrate on building foundations. The axiomatic approach should be used wherever possible; this is well appreciated, understood, and followed by the kind of student in the program. Example problems and assigned problems should be carefully selected or designed so that the student can gain experience with analysis and design examples capable of being extrapolated to more complex situations.

5. It is important to bear in mind that the participants have a high level of personal and scholastic maturity: they should be treated as graduate students, even though they are taking undergraduate course-work; authoritarianism, academic or administrative, should be selectively applied---only where it is necessary, and only where it is real. Cooperation by the students can be expected; they are able to appreciate teaching strategies (a number of them are teachers), and they are eager to help make the program work.

6. Faculty selection is, of course, critical to the success of the program. It is very important that some of the faculty be readily available to the students at all times. Approachability, interest in students, adaptability to non-traditional modes of education are some obvious criteria. Actually, all the faculty and staff of the major department should be available in some degree to the Fast-Track students. The students must sense full acceptance by the department.

7. Throughout the program the electrical-track participants exhibited significantly greater motivation, interest, drive, cooperation, and dedication than is evident in the case of the regular departmental majors. Again, this is evidence of greater maturity; the Fast-Track students see their goals clearly and they are very serious in their determination to reach them. They know that they must learn the material, the concepts, and the experimental techniques; not just pass the courses.

8. The initial courses must be specially designed for the Fast-Track students and there are obvious academic and psychological reasons for segregating the Fast Track participants and the regular students at that time. It is, however, highly desirable to integrate Fast Track and regular majors after the transitional and familiarization period has been completed. Judging by the experience gained in the program, it is observed that the Fast Track students compete easily with the regular students; indeed, they often out-perform the regular students. This builds confidence in the participants, and the mutual interaction is beneficial to both groups of students for several reasons.
9. Again, based on experience, there are a number of specific recommendations for improving the follow-on programs;

   a. Participants should be able to actually complete a second bachelor's degree during the time-span of the program.
   b. There should be more time for training in support courses such as strength of materials, thermodynamics, and engineering economy.
   c. Experimental laboratory opportunities should be included in the program. Such work can start soon after the transitional and familiarization courses are completed. An "open-laboratory: format is recommended.
   d. It is important that computer programming be included in selection requirements. Hands-on microprocessor training should be included in future programs.

The Curriculum - Chemical Engineering

1. Planning and Development

The Chemical Engineering curriculum was originally developed jointly with the Monsanto Research Corporation of Dayton, Ohio. Monsanto had an interest in retraining a number of their full-time chemists as chemical engineers. The structure of the Monsanto Retraining Program evolved from discussions between the Chemical Engineering Department of the University of Dayton and various groups from Monsanto including engineering supervisors, potential participants, and personnel coordinators. These planning meetings occurred in the Spring of 1975 with the formal classroom instruction beginning in the Summer of 1975. The part-time Monsanto Retraining Program was successfully completed in the Spring of 1977.

The curriculum followed in Fast-Track I was based on the one developed for and experience with the Monsanto Program. More importantly, the curriculum closely paralleled our Bachelor of Chemical Engineering degree program. That is, the course content and sequencing was similar to the normal undergraduate program, thereby taking advantage of the extensive experience associated with the Bachelors degree program and allowing substantial flexibility between the Fast-Track I Program and the Bachelors degree program. The Fast-Track I Program did not include several courses found in the last term of the Bachelors degree program, due to time constraints (accounting for the primary difference between the two programs).

These "missing" courses were available at most Universities offering a major in Chemical Engineering and were also available through correspondence with the University of Dayton, thereby allowing Fast-Track I participants to easily pursue a Bachelor of Chemical Engineering degree from the University of Dayton.

Typical chemists have a relatively weak background and a low confidence level in mathematics. As a consequence, two critically important initial courses in the Fast-Track programs were a "Special Topics in Mathematics" (which reviews college level calculus) and "Applied Differential Equations" (the normal mathematics prerequisite for upper level engineering courses).

2. Curriculum Modifications

The original curriculum proposed to the National Science Foundation for Fast Track I consisted of twenty-six semester hours of credit in residence. The number of credit hours was relatively small (a normal undergraduate would carry about 40 semester hours during a twelve month study period) in order to give the participants an opportunity to do well in the courses as well as to pursue part-time employment if necessary.

The number of hours was extended to thirty hours during the course of the contract for several reasons. Virtually all of the participants indicated a desire to complete a degree program, which, by University regulation, requires thirty hours at U.D. and, indeed, adequate time was available to the participants to accommodate additional courses. As a consequence, the originally scheduled course "Special Problems in Kinetics" (2 credit hours)

was changed to the regular undergraduate course entitled "Kinetics" (3 credit hours) and the introductory course "basic Electric Theory" (3 credit hours) was added, thereby bringing the total number of hours up to the required 30 hours in the Fast Track I Program.

The Chemical Engineering participant still needed at least two additional courses, entitled "Process Control" and "Unit Operations II" (3 credit hours each) to complete Departmental requirements for a Bachelor of Chemical Engineering degree. It should be noted that eight of the nine participants completed the Process Control course during their fifth and sixth terms in the program, paying their own tuition. Other requirements were identified on an individual basis, corresponding to gaps in educational backgrounds.

Based on experience with the Fast Track I program, the Fast Track II program included 39 hours of course work. The participants in Fast Track I had indicated an interest in and time available for the "Process Control" and "Unit Operations II" courses. This assisted the participant in completing all of the Chemical Engineering coursework in the program; if a participant needed additional work to complete the Bachelor of Chemical Engineering degree requirements, the courses were not specialized technical courses, but usually readily available at other universities; a typical example involved needing Physical Chemistry.

3. Content

The Chemical Engineering curricula, as it evolved in Fast Track I, is shown in Table A and Fast Track II is shown in Table B. The course descriptions are shown in Table C. These courses represent the core of the Chemical Engineering degree program at the University of Dayton. When combined with the training received in an undergraduate degree in Chemistry they form a potent combination that prepares an individual to proceed directly to chemical engineering positions in industry or to pursue graduate studies in Chemical Engineering.

4. Reactions to the Students by Faculty

Since Chemical Engineers frequently and naturally interact with Chemists, no surprises were anticipated by the faculty. In addition, most of the Chemical Engineering faculty had

participated in the Monsanto Retraining Program. In retrospect, the faculty was impressed by the competance and the dedication of the participants. This may be partially attributed to the very conservative criteria used to judge a candidate's ability to complete the Program. In particular, the acceptance criteria in mathematics was severe; the pay off involved the fact that none of the candidates accepted into the Program had problems with mathematics.

5. Recommendations for Future Programs

No specific recommendations. The program is strong and stands alone.

TABLE A

CHEMICAL ENGINEERING CURRICULA (FAST TRACK I)

TERM	HOURS	COURSE NUMBER AND TITLE	
1	3	MTH 490	Special Topics in Mathematics
	2	CME 499	Special Problems in Material and Energy Balances
2	3	MTH 219	Applied Differential Equations
	2	CME 499	Special Problems in Thermodynamics
3	3	CME 324	Transport Phenomena I
	3	CME 321	Basic Electric Theory
4	3	CME 325	Transport Phenomena II
5	3	CME 306	Kinetics
	3	CME 411	Unit Operations I
6	2	CME 413L	Unit Operations Lab
	3	CME 430	Chemical Engineering Design
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TABLE B

CHEMICAL ENGINEERING CURRICULA (FAST TRACK II)

TERM	HOURS	COURSE NUMBER AND TITLE
1	3	MTH 490 Special Topics in Mathematics
	3	CME 203 Material & Energy Balances
2	3	MTH 219 Applied Differential Equations
	3	CME 305 Thermodynamics
	1	EGI 499 Professional Development
3	3	ELE 321 Basic Electric Theory
	3	CME 306 Kinetics
	3	CME 324 Transport Phenomena I
4	-	ELE 321 (continued)
	-	CME 306 (continued)
	3	CME 325 Transport Phenomena II
5	3	CME 411 Unit Operations I
	2	CME 413L Unit Operations Laboratory
	3	CME 452 Process Control
6	3	CME 412 Unit Operations II
	-	CME 413L (continued)
	3	CME 430 Chemical Engineering Design
	-	CME 452 (continued)

TABLE C

COURSE DESCRIPTIONS FOR CHEMICAL ENGINEERING OPTION

TERM	COURSE DESCRIPTION
1	MTH 490 REVIEW OF CALCULUS AND ANALYTIC GEOMETRY: Functions and their representation, Limits and continuity, The Antiderivative, Chain Rule of Differentiation, Logarithmic and Exponential Functions, Using Tables of Integrals, Functions of Two Real Variables.
	CME 499 SPECIAL PROBLEMS IN MATERIAL AND ENERGY BALANCES: An introduction to chemical engineering with lectures and problems on material and energy balances as applied to industrial processes. 2 sem hrs.
2	MTH 219 APPLIED DIFFERENTIAL EQUATIONS: First order equations, linear differential equations of higher order with constant coefficients, power series solutions, the Laplace transformation, numerical methods, applications to physics and engineering. 3 sem hrs.
	CME 499 SPECIAL PROBLEMS IN THERMODYNAMICS: Development of the fundamental principles of thermodynamics, particularly with respect to chemical engineering processes. 2 sem hrs.
3	CME 324 TRANSPORT PHENOMENA I: Viscosity, shell momentum balances, isothermal equations of change, thermal conductivity, shell energy balances, nonisothermal equations of change, diffusivity, concentration profiles. 3 sem hrs.
	ELE 321 BASIC ELECTRIC THEORY: For chemical, civil, and mechanical engineering students. Fundamental methods of analysis in DC and AC circuits. 3 sem. hrs.
4	CME 325 TRANSPORT PHENOMENA II: Friction factor, dimensionless correlations, isothermal macroscopic balances, Bernoulli's Equation, heat transfer coefficients, heat transfer correlations, heat exchangers, nonisothermal macroscopic balances. 3 sem. hrs.
5	CME 306 KINETICS: Reaction kinetics, catalysis, and adsorption. 3 sem. hrs.
	CME 411 UNIT OPERATIONS I: Fluid mechanics, transportation of fluids, flow of heat, evaporation, filtration, and mixing. 3 sem. hrs.
6	CME 413L UNIT OPERATIONS LABORATORY: Unit operations equipment and its utilization. 2 sem. hrs.
	CME 430 CHEMICAL ENGINEERING DESIGN: Study of the principles of process development, plant design, and economics. 3 sem. hrs.